SCIENTIFIC AMERICAN

Escape from a Wrecked Submarine

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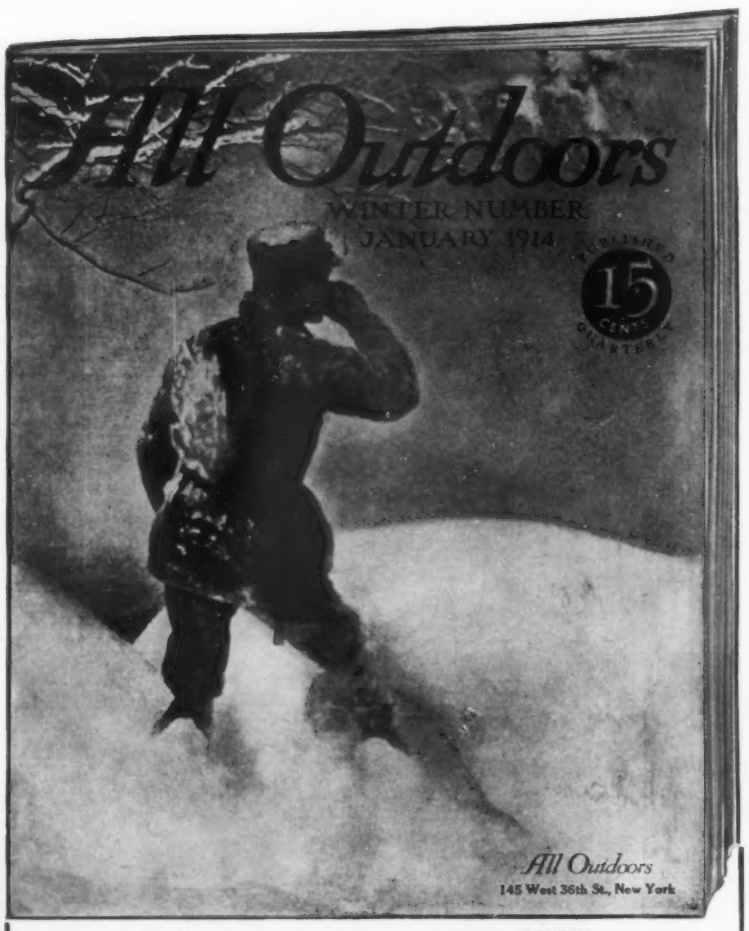

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VOLUME CIX
NUMBER 21.

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Weighing Half a Million Freight Cars

THE importance of the weighing of freight cars on a great railway system can be readily appreciated, as it is the basis on which charges for transportation are assessed and is a matter in which both shipper and carrier have the greatest concern. Nowhere is this impressed more forcibly than at one of the great railroad centers where the freight cars are weighed and distributed to be made up into proper trains. Such a yard is that at Juniata, Pa., on the Pennsylvania Railroad, and over its track scales passes an enormous volume of traffic. In the year 1912, 468,194 cars with an aggregate weight of 23,065,750 tons were weighed at the Juniata scales, which involved freight earnings totaling the not inconsiderable sum of $25,312,857.92.

Is it to be wondered, therefore, that the design, construction, and maintenance of track scales are a matter of prime importance, for an error seemingly slight in a single weighing if continued would soon run into startling figures with a corresponding effect on the revenue account to the disadvantage of either the railroad, shipper, or the stockholder.

A representative of the SCIENTIFIC AMERICAN recently witnessed the regular routine weighing at the Juniata scales and observed a periodic test. With an average of 1,597 cars weighed daily, the question of getting the cars to and on the scales, as well as weighing them with proper accuracy, becomes an interesting problem. So rapidly must the cars be moved and made up into trains that they are weighed in motion, as one by one, cut loose from a train pushed by a switching engine, they pass across a 52-foot scale rail on the platform of the scale, and then passing off by gravity they are switched to the proper classification tracks.

The entrance to the classification yard is over the scales, which are provided in duplicate, an emergency scale the exact counterpart of the regular scale being located by its side. These scales, shown in the illustration, represent the standard practice of the Pennsylvania Railroad and consist of a four-section lever scale fitted with suspension bearings, where the load is hung from the knife edges of the main levers and is not superimposed directly upon them as in the case of older types. The main levers are transverse to the principal axis of the scale and communicate their motion to the center or extension levers, by which it is transmitted to the fifth lever and thence to the beam, the general arrangement being that of a compound lever having the same effect as a simple lever, where a weight of 25 pounds acting on the end of a power arm 12,000 times as long as the weight arm, would support a weight of 300,000 pounds. There is a relieving gear consisting of mechanical jacks supporting the bridge frame on which the ties and track are laid, operated by a toggle joint arrangement worked by a cylinder and piston supplied with hydraulic or air pressure and at the control of the weighmaster with a valve, so that the bridge or girders carrying the track can be relieved and supported rigidly when a train, car or engine is passing without being weighed.

In weighing a car it is brought to the scales in a long train amounting sometimes to one hundred cars. At a point about 50 feet from the end of the scale the grade begins to rise, forming what is termed a hump in the track. As the end car reaches the apex of this hump it is uncoupled and then pushed over, and due to the descending grade it leaves the train at somewhat greater speed, but never more than four miles an hour, and passes across the scale platform. The weighmaster and his clerk stand in front of the beam in a bay window in the scale house and as the car gets on the track the movable poise is adjusted until the beam balances, when the indicated weight is called to the clerk, who by this time has noted the number of the car and the stenciled tare or weight of the car empty painted on its side. The car then passes off the scale platform, which is at a grade of 0.8 per cent, and down a short piece of straight track, where it is switched as desired. If the weighmaster detects an overloaded car he pulls the cord of a whistle and the car is switched to a track to be trimmed or examined, or in case the car goes so fast that the weighmaster is unable to make a reading it is sent to a track whence it can be taken over to the scale again by a switching engine.

Steadily the cars pass over the scale, and the weighmaster rapidly moves it along the beam after a swift glance to gain a general idea of the kind of car and, if open, its contents. Three or four cars a minute can be weighed by an expert weighmaster.

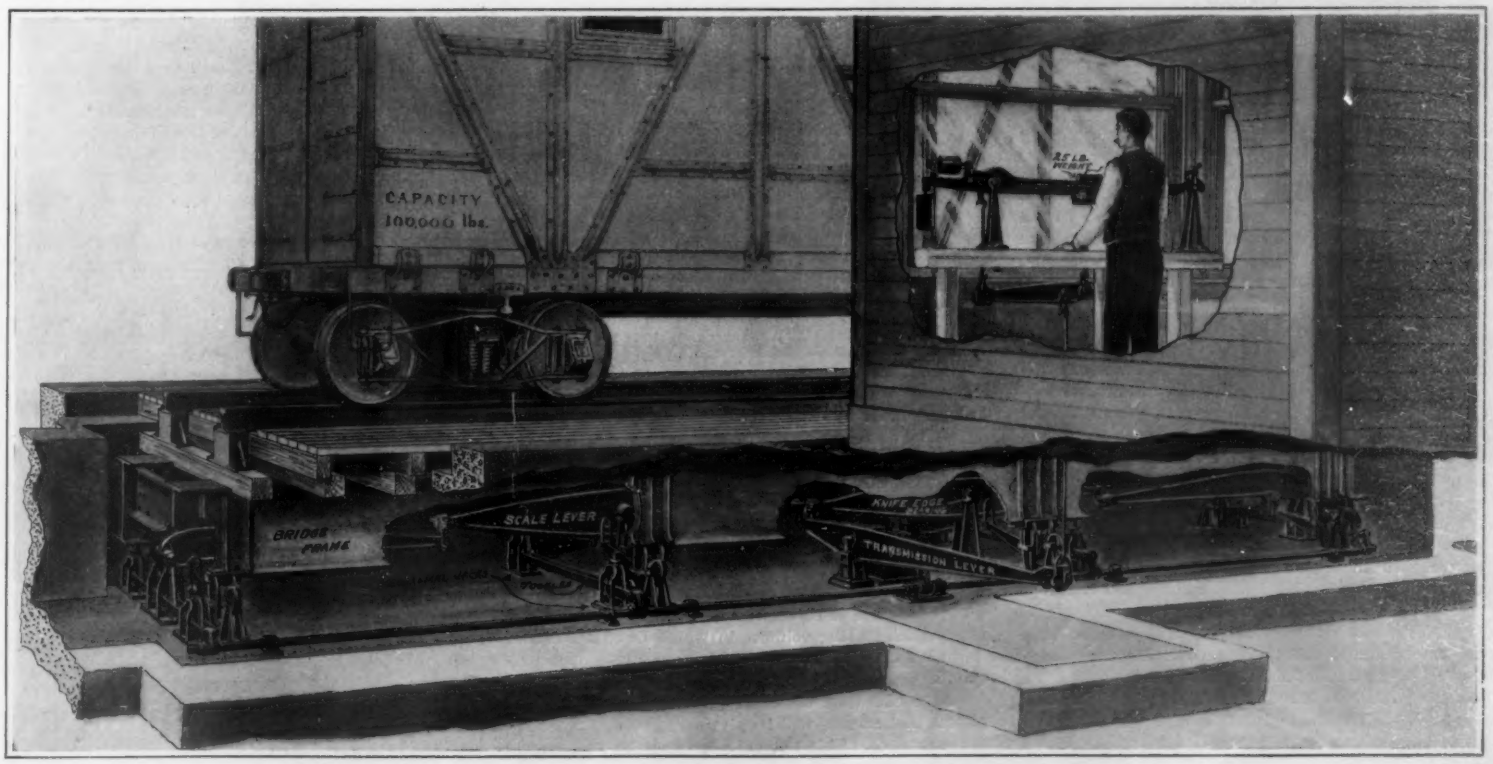
Sometimes a car weighed accurately at rest by the scale inspectors is included in a train as a surprise test for the weighmaster. The scale itself is balanced daily before beginning weighing and is frequently tested by the weighmaster with loaded cars at rest on different parts of the platform. As the scale is a compound lever in four sections and the weight is distributed on eight main bearings or knife edges of the main levers it is desirable to test each set with the load directly above them. The usual method is to take a test weight car, a small low self-contained car of all metal construction, and placing it successively above each set of main levers, make a series of readings. The master scale on which the test car is weighed and sealed is accurate to one part in 50,000, being adjusted and calibrated to United States standard weights.

In the test witnessed by the writer, the test car was just from the master scale and its sealed weight was exactly 30,000 pounds. It was placed on the scales and the poise was moved along the beam until it balanced, swinging freely and coming to a position of rest. The main poise is graduated to 1,000 pounds and the fractional or lower poise enables readings down to 10 pounds to be made. The emergency scale when tested was shown correct for all sections, and the same was true for the regular scale with the exception of one section which was 10 pounds out of the way, which led the inspector to examine the appropriate levers.

All the readings being the same at each section is not necessarily guarantee to the correctness of the scale unless they are the same as the weight of the test weight car. If all differ the adjustment must be made at the various levers by a process of trial and error. If all readings agree, but are in error by the same amount, then a simple adjustment of the length of the fifth lever is usually sufficient to make the scale accurate.

If the scales are kept clean and properly maintained, there is little need of adjustment. The levers of such a scale are all carefully sealed and adjusted in the shops and the parts are all interchangeable so that in case of accident, on receipt of a telegraph order, a new part can be sent by passenger train from the scale shop.

The process of scale testing is rather complicated in its application and practice, and the technique only comes with considerable experience. The inspector goes about with his test car on a trip of from six to eight weeks testing scales and then returns to Altoona for a reweighing on the master scale, and examination of the car, as only the most necessary repairs are allowed on the road. The bearings are responged and the car thoroughly cleaned. This work on the Pennsylvania is well done, and on a few other great systems, but there has been so much discussion of the shortcomings of railroad weighing that there is now in progress an investigation by the United States Government of the track scales throughout the country.



Weighing a freight car on a Pennsylvania Railroad 52-foot standard 300,000-pound capacity track scale.

Note the relieving gear supporting the bridge frame when no weighing is in progress.

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Water Supply of Cities Ancient and Modern

WILL it surprise the citizens of New York, in the year 1913, to learn, if they did not know it before, that the citizens of Imperial Rome in the year A. D. 300, or thereabouts, were favored with a supply daily of somewhat over 400 gallons of water per capita, as against a supply daily of about 100 gallons per capita which is available at the present writing in this city? Manhattan and the Bronx, with a population of about 3,000,000, receive daily from the Croton watershed about 300,000,000 gallons; but Imperial Rome brought in by aqueduct, chiefly from the distant hills that encircle the Campagna, over 400,000,000 gallons of water per day—and this, by the way, is four fifths of the total supply which will be led from the Catskill mountains to this city, when the new Aqueduct is completed—and New York, be it remembered, in respect of its water supply, ranks high among the capital cities that are the boast of our modern civilization.

A great constructive people were those Romans of the days of the Cæsars. Of pure science they knew not a little, and in practical science so adept were they, that the monuments of their engineering skill take rank with the noblest engineering works of the twentieth century.

Consider this matter of water supply. Any one who is not fully conversant with the luxurious life of that great people might readily suppose from the statistics which we have given above, that they were afflicted with a positive mania for aqueduct building. Nothing of the kind. The Romans had a full appreciation of the value of an abundant supply of pure water, as ministering to the health, the pastimes and the artistic delight of a city of one million souls. The Romans of Imperial days had a passion for cleanliness of body, and the stupendous public baths such as those of Trajan Diocletian and Constantine, were capable of accommodating at one time from 1,600 to 3,600 bathers. Says Prof. Lanciani: "If we take 1,500 people as the average accommodation of each of the public thermæ and 50 as that of each of the private baths, we find that in ancient Rome at any given time, nearly 63,000 citizens could restore their strength in baths of every nature and description." The water in Rome was the property of the crown, and it was led to the private houses by thousands of pipes, which ran in every direction and under every street, and were stamped with the name of the "Concessionaire" to whom it was brought from the nearest crown-reservoir.

The Roman was nothing if he was not artistic, and huge draughts were made upon the city supply for the magnificent series of public fountains which graced the public squares and plazas, and were to be found casting forth the mountain waters from every point of vantage. To these must be added the thousands of fountains which played in the gardens and courts of houses and villas of pretention, to say nothing of the supply which was necessary to maintain the beautiful cascades and silent pools which formed one of the most lovely attractions of a Roman garden.

To the engineer and artist alike, the most attractive feature of the water supply of Rome is the aqueducts, the remains of which, in many a mile of picturesque ruins, radiate across the desolate and solitary waste of the once fertile Campagna in the direction of the distant hills. Of these aqueducts there were eleven, or, if we include the tributaries, fourteen in all. Their individual length varied from a minimum of eleven miles to a maximum of fifty-nine miles. Their total length was three hundred and fifty-nine miles, and of this, three hundred and four miles were below ground and fifty-five miles were carried on monumental arcades of masonry, much of which has survived practically intact for upward of two thousand years.

The question may be asked as to why the Roman engineers built these grade-line aqueducts, bringing the water across the Campagna in costly elevated artificial river beds, when they might have built conduits that followed the undulations of the country and were sunk only a few feet below the surface. The answer is that the Romans had no cast iron or other suitable material to construct the strong piping which would have been necessary to withstand the pressures. They were acquainted with the principles of the siphon; indeed they built many notable specimens, one of which, that of Alatri, built a century and a half before the Christian era, was capable of supporting, we are told, a pressure of 140 pounds per square inch.

Let it be understood, furthermore, that the Romans did not merely divert the water from the river beds into their aqueducts, thereby exposing the supply to contamination by the mud and silt of the river floods. On the contrary, they thoroughly understood, and practiced on a grand scale, the art of impounding the supply by means of artificial dams. Thus the valley of Anio was dammed at three successive places, and at each dam was formed an artificial basin, in which the water deposited its sediment and from which it was led off, clear and pure, to the city. Also, the Roman engineers understood all about tunnel construction; and in one case, between Tivoli and S. Gericomio, a tunnel some three miles in length was driven through the mountain simply for the conveyance of the water.

All of which reads very much like some of those descriptions which we have published recently in these columns of the great water supply systems of Los Angeles and New York.

Science and the Education of the Future

TO the average citizen of to-day science appeals through its manifold applications. Its function appears primarily, to some perhaps wholly, utilitarian. Indeed, some hold that science which does not lead to practical application is heresy.

If this be so, it appears at first sight as if science as a subject of study for the young, the adolescent and the mature, could never offer more than a limited educational discipline. But this is an utterly false conclusion. It arises out of a misconception of the meaning underlying that much-abused word "practical." Any thing or action is "practical," which is conducive of benefit to mankind. It is a grossly narrow view which sees benefit only in the production, transportation and bartering of merchandise—whether this be food, clothing, buildings, materials of construction or what not—and which reckons scientific pursuits as "practical" only if they can be traced forward to the ultimate production of such merchandise.

The needs of man are not purely material. From time immemorial his mind has hungered for an interpretation of the phenomena of nature about him. Primitive man of the gray dawn of history, and the savage of to-day, peoples space about him with spirits and demons, to whom he ascribes the power of shaping events and destiny. To them he offers supplication to engage their favor and to appease their anger. This, the crudest kind of religion, is at the same time the crudest kind of science. Because it has no obvious relation to the production of merchandise, are we to remain indifferent to the development of this aspect of science? If we could do so without forfeiting all our industrial achievements, would we be willing to go back to that state of scientific ignorance which would bid us offer human sacrifice to appease a rain god? Would it be "practical" to do so? Men forget that evil comes not only of ill-will, but also of ignorance, and that science brings benefits by clearing our vision—a matter which may be of greater importance than the invention of some "practical" machine or process.

Viewed in this way, science has a high humanitarian value, and its study must rank side by side with that of ancient and modern literature. If any one still doubts this, after what has been said above, let him ask himself how many works of literature or fiction have had a greater influence upon modern thought in all its phases and throughout the civilized world, than those epoch-making volumes in which Darwin has laid down his classical researches and reflections upon evolution.

In the education of future generations we may well expect that science will be given a more and more important place. This not only because the young must be prepared for the tasks by which they will later in years earn their subsistence, but also because science, when construed broadly, has its lessons for us on many topics of the most vital interest to the life of body and soul. We would not contend that it can ever take the place entirely of literature and art in its formative influence upon character; but it will be a complement to them, a complement for which there is a crying need to-day: Literature and art deal with ideals; science deals with reality. Literature and art point us a way, show us an aim, science teaches us the limitations of our resources and powers, and brings us back to earth—from the world of dreams to the world of action, from the world of purposes to that of accomplishment. It makes us "practical" in the best sense of the word, for "practical" indeed we must be in order to translate our ideals into reality.

Which End of a Post Should Be Up?

IT is a very common belief among farmers that a post will last longer if set in the ground the reverse of the way it grew in the tree, in other words, with the butt end up. Accordingly, one sees many posts, especially end and gate posts, with the small end down. The supposition is that sap in a tree is always ascending, or at least that it is easier for the sap to go up than down. Consequently, it is argued, turning a post upside down tends to prevent the rise of water, helps to keep the wood dry and therefore renders it less liable to decay. As a matter of fact, sap or water can flow in either direction with equal facility and the popular notion to the contrary is incorrect.

Careful experiments on the relative durability of post timbers have been made by the Ohio Agricultural Experiment Station and the above question was considered. One fence in particular contained 156 black locust posts, of which 86 were set with the top end up, 39 with the top end down, and 31 did not show in what position they were set. At the end of 20 years 30 posts, or 19 per cent, were decayed. Of this number 15 were top up, 13 top down, and 4 undetermined. In other words one third of those set top down rotted off, as compared with only a little over one sixth of those set top up. From this and numerous other observations the conclusion was reached "that there is no difference which end is put in the ground, except that the sounder or larger end should have the preference."

The decay of a post is mostly at the ground line, since it is there that the conditions as to air and moisture are most favorable to the development of rot-causing fungi. Other things being equal, the larger the post the longer it will last. Inverting a post often means putting the small end in the ground, and where this is done the time required to rot it off is less than where the big end is down. If both ends are equally sound the larger should go in the ground. If one end is defective is should be up, since the conditions above ground are many times more favorable to durability than just at or below the ground line.

What Is Impure Air?

THE Smithsonian Institution has recently published a revolutionary memoir by Prof. Leonard Hill and several collaborators, entitled "The Influence of the Atmosphere on Our Health and Comfort in Confined and Crowded Places." A main purpose of the memoir is to show that the chemical quality of the air in crowded and stuffy rooms has nothing to do with its ill effects, and that, apart from the influence of infecting bacteria, the ventilation problem is essentially one of the temperature, relative humidity and movement of the air. The ordinary tests of air for carbon dioxide are declared to be worthless. The percentage of carbon dioxide in the worst ventilated room does not rise above 0.5 or, at most, 1 per cent, whereas the normal concentration of carbon dioxide in the lungs is from 5 to 6 per cent of an atmosphere. The writers adduce a great number of experiments and observations to prove that percentages regarded as deleterious or deadly by hygienists are quite harmless. They claim that it is also a fallacy to assume that a diminished amount of oxygen is harmful. At noted health resorts in the Alps the barometer stands at such a height that the concentration of oxygen is far less than in the most ill-ventilated room. One unfortunate result of this fallacy is that the laws regarding ventilation of mines insist on a high percentage of oxygen, and thereby increase the danger of mine explosions. Finally, the widespread belief in the presence of an organic poison in expired air is equally erroneous. The smells of crowded rooms and the like are no indication that the air is deleterious. "The deaths in the Black Hole of Calcutta, the depression, headache, etc., in close rooms, are alike due to heat stagnation; the victims of the Black Hole died of heat-stroke."

Canada cuts about two million cords of pulp wood annually, about half of which is exported for manufacture in the United States.

Engineering

The Borsig Locomotive.—In our illustrated article of September 20th, 1913, describing the powerful Diesel locomotive, we omitted to state that this very interesting machine was built by the well-known German locomotive builders, A. Borsig, one of the oldest and largest locomotive building firms in the world.

A Thousand-foot Dry Dock for New York.—If New York is not to be at a serious disadvantage, as compared with the ports at Quebec and Boston, it must provide its own dry dock for the accommodation of the largest ocean liners. As noted in these columns, both of the two ports above mentioned are building dry docks capable of accommodating ships 1,000 feet in length, and this in spite of the fact that there is no prospect that ships of this size will call at any other port than New York for many years to come. We are pleased to note that the Dock Commission is planning to build a dock of this size at South Brooklyn.

Excavations as a Cause of Earthquakes.—We note that in a contemporary journal a correspondent has made the suggestion as to the cause of the recent earthquake shocks in Panama, which is more ingenious than it is convincing. He draws attention to the fact that over 200,000,000 cubic yards of material has been removed from the Culebra cut and deposited elsewhere. This, he argues, involved a readjustment of weights on the surface which, taken in connection with such heavy blasts as that of forty tons of dynamite, which was used to destroy the Gamboa dike, may have had some predisposing effect on the recent earthquake shocks.

Size Favors Economy in Ships.—In the recent James Forrest lecture before the Association of Civil Engineers, Alexander Gracie gave particulars showing that increase in size is accompanied by reduction in cost of construction and operation of cargo steamers. A cargo vessel 400 feet long and weighing 3,700 tons will carry 4,000 tons of cargo 3,000 miles on a consumption of 500 tons of coal. Each hundred tons of cargo will involve 92½ tons of structural material and 12½ tons of coal per voyage. In a vessel 500 feet long, weighing 8,700 tons, each 100 tons of cargo will require only 77½ tons of ship and 8 tons of fuel.

Ashokan Dam Filling With Water.—The west basin of the Ashokan dam is now filling with water, which is being admitted mainly to prevent a growth of new vegetation, which if it were left dry would quickly cover the basin. Next spring the east basin will be covered with water for the same purpose. Probably no draft will be made upon the west basin supply for another year but in case of a dry season it will be possible to replenish the Croton Lake from the west basin of Ashokan. This means that by the first of next year it will be possible for residents of New York to draw water directly from the Catskill Mountains. The dam will have in the two basins a capacity of 130,000,000,000 gallons of water, sufficient to supply New York city with 500,000,000 gallons daily.

Copper Wire by Electro-depositing.—A process has been devised for the manufacture of copper wire by electro-deposition. *The Brass World* states that previous attempts to accomplish this object have been unsuccessful. The method requires a fine copper wire as a core for making the desired product, and the additional copper is deposited on it while it moves through a tank containing the solution. The fine copper wire is made endless and passed through a regular plating solution containing sulphate of copper and a little sulphuric acid. The wire passes over grooved rollers operated from outside while passing through the tank. After leaving the tank the wire passes through a small rinsing tank to remove the solution, and then goes to a reel around which it passes a number of times, returning again to the plating tank. The plating may thus be continued until the required thickness is obtained.

Automatic Stop Progress.—It has been announced by the Maryland and Pennsylvania Railroad that the Jones automatic train stop and cab signal is to be installed on a length of seven miles on this road, and that during the coming year the road will be equipped for its use over an additional nineteen miles, making twenty-six miles on which this system will be in service. The automatic stop of the Union Switch and Signal Company is being tried on the Delaware, Lackawanna and Western near Newark, N. J. This road is also installing the Federal Signal Company's audible signal for test. The New York Central and Hudson River Railroad is testing the Induction Signal and Safety Company's system; and the New York, New Haven and Hartford will test the installation of the Union Switch and Signal Company, and another installation is to be made for test on that road by the International Signal Company. The Pennsylvania Railroad expects soon to test the induction apparatus of J. P. Finnegan, and they have been experimenting with the Gray-Thurber automatic stop. The Buell automatic train stop is still under test on the Queen and Crescent Railroad.

Science

The "Terra Nova," the ship of Captain Scott's Antarctic expedition, recently left Cardiff for St. John's, Newfoundland, where she is to re-engage in the whaling and sealing industry, in which she was employed until engaged for service in the Antarctic. Her figure-head has been presented to the City Council of Cardiff.

Remarkable Solar Halos were observed at various places in the central United States on November 1st and in the Atlantic States on November 2nd. In some cases (as at Springfield, Mo., on the 1st, and in southern Virginia on the 2nd) the displays were among the most highly developed combinations of halo phenomena ever seen in temperate latitudes, being a rather close reproduction of the famous "Petersburg phenomenon," seen by the astronomer Lowitz in 1790. The SCIENTIFIC AMERICAN hopes to publish a more detailed account of these unusual displays in a future issue.

Ashmead Gray Rodgers, for twelve years superintendent of the Carborundum Company's plant at Niagara Falls, died October 23rd, 1913, as the result of injuries sustained through an accident October 5th. Mr. Rodgers was born in Albany, N. Y., in 1872. Previous to his coming to the Carborundum Company as superintendent, he was superintendent of the Eddy Electrical Company at Hartford, Conn. Mr. Rodgers was a member of the American Chemical Society, Engineers' Society of New York, Chemists' Club, Niagara Club, University Club and Country Club of Niagara Falls and other scientific and social organizations.

An International Pharmacopoeia Office, the creation of which has recently been urged by Prof. A. Tschirch, of Berne, would have at the outset for its principal task the collection of literature relating to all the drugs and preparations in the, at present, heterogeneous national pharmacopoeias of the world. Another undertaking would be the standardization of methods of determining the strength and purity of drugs. The project of an international pharmacopoeia has often been discussed at medical and pharmaceutical meetings, but thus far without tangible results. There are now 20 national pharmacopoeias, besides "extra" pharmacopoeias and other supplementary works; and although collectively they recognize several thousand medicines, only about 150 are common to them all. The French "Codex" is more extensively used than any other national pharmacopoeia outside its own country. There are, however, several unofficial universal pharmacopoeias which serve to show the comparative strength of parallel preparations in different countries.

Seaweed Burning in Norway is one of the interesting out-of-the-way industries recently described in the United States consular reports. An enormous amount of seaweed is deposited on the coast by the waves in spring, and in some places the weed is cut by boatmen. Two-wheeled wagons are loaded with the wet, slimy weed, which is taken up the beach and spread out like hay to dry. It is then raked up in heaps and burned. The ashes are exported to Scotland, where they are used in the manufacture of iodine, and sell for 1.3 cents a pound. For the past 45 years seaweed ashes have been exported regularly from Stavanger to Scotland to the extent of 1,500 tons and upward per annum. This industry is an important source of revenue to the peasants who are fortunate enough to possess riparian rights, and attempts to purchase such rights from their hereditary owners rarely succeed. For a time the burning of seaweed was prohibited through the influence of the fishermen, who declared that this practice drove the fish away from the coast.

Tunneling the English Channel has been talked of for generations, and from time to time the scheme seems on the verge of realization, only to be relegated soon after to semi-oblivion. It is now again occupying the attention of the British government. On August 5 a deputation representing some 90 members of the House of Commons was received by Mr. Asquith, who, in reply to their advocacy of the undertaking, reviewed the history of the proposal. As far back as 1874 the idea was approved by the Foreign Office, but from 1883 onward the government has consistently opposed it, mainly on military grounds. It was strongly opposed by Lord Wolseley. From an engineering point of view the project is entirely feasible. Three methods of securing continuous railway communication between England and France have been suggested; viz., a tunnel, which would cost not less than £8,000,000; a bridge, which would cost £22,000,000; and a train ferry, which would cost £2,000,000. The real reason for the sentiment prevailing in England against these projects appears to be, to quote the London *Times*, "a half-articulate feeling, deep-seated in the heart of the nation, instinctively urging it to repel without question what it believes to be an attack on its individuality. It is difficult for Continental peoples to realize the peculiar quality which the possession of an island kingdom breeds in a race. The moral effect of the 'continuous road into Europe' would be immediate and striking, but it might also be disastrous."

Aeronautics

A Royal Aeronaut.—Archduke Josef Ferdinand, of Austria, has justified his predicate of "Imperial and Royal *Highness*" by making 100 balloon voyages.

The Psychology of Air Scouting.—In actual war, both in Tripoli and in the Balkans, aviation accidents were conspicuously few, and this despite the fact that winds were generally high in Tripoli, and the season of the year and the weather extremely unfavorable in the Balkans. It is a matter of considerable psychological interest to note that the danger from an enemy's fire so stimulates vigilance that nerves are tense with exertion and the mind is relieved from dwelling upon the ordinary dangers of keeping an aeroplane on an even keel and meeting every gust. In other words, scouting in actual warfare seems to be a splendid cure for nervousness. The aviator must fly with the assurance of a bird, and he does so for fear of the enemy's rifle fire. A striking instance of this psychological phenomenon is the fate of Dr. Jules Constantin, a French aviator in the Bulgarian service. He was mortally wounded in the air during a flight above Tchatalja, as we recorded at the time, but managed to land safely only to die before anyone could reach him. His dead hand still grasped the steering lever; a bullet-hole was in his breast. The feeling of detachment from the ground at 3,500 feet probably dispels intense fear. It is very significant that, because everything is heard so clearly in the air, even to such trivial noises as the barking of dogs and the cackling of hens, the roar of battle is exaggerated and seems more intense and tremendous than it really is.

Recent Aeroplane Patents.—A patent, No. 1,074,007, has been issued to Frederic Mylius of Atlanta, Ga., for an aeroplane which has a transverse carrier plane whose upper surface is concave, and rearwardly converging guide planes which are secured at their forward ends to the carrier plane and have their upper surfaces concaved adjacent their forward ends and convexed adjacent their rear ends. In a patent, No. 1,074,063, to Harry A. Orme of Wesley Heights, D. C., is shown a vertical steering plane with a curved slot and a horizontal elevating plane slotted to receive the vertical plane and movable from side to side, a rib of the horizontal plane working in the curved slot of the steering plane. Ralph P. Fox of Fort Hancock, N. J., has secured a patent, No. 1,073,977, for a safety support for flying machines in which is provided a main supporting surface, an auxiliary balancing and supporting surface in front, rear and at opposite sides of the machine and beyond the main supporting surface, the balancing surfaces being of circular form in plan and elliptical form in vertical section and presenting opposed upper and lower convex resisting surfaces. Cleve T. Shaffer of San Francisco, Cal., in a patent, No. 1,071,101, provides an apparatus in which an aeroplane is supported and propelled along a track and is flexibly connected with the track, means being provided for controlling the flexible connections for regulating the universal movement of the aeroplane relative to the supporting track.

Armored Aeroplanes in France.—It appears that the German war department took the lead in protecting aeroplanes by armor plating, and after this the idea was taken up in France, where several armored flyers were to be seen at the last Paris show. However, the French army did not go extensively into the matter before attention was called to it by two events, one being the experiments made at the Toulon arsenal in firing upon aeroplanes last year, and the second the results of the first war in the Balkans. It was then recognized that all aeroplanes were vulnerable when flying below 4,000 feet, and with the present system of observing, a machine needs to fly as low as 2,000 to 2,500 feet in order to see the state of affairs on the ground. It would thus be exposed to artillery and infantry fire. Two solutions were presented for protecting aeroplanes, first to armor plate for the men, motor and devices, or only to protect the aeroplane guns and in this case keep the flight very high so as to prevent being hit. Here the observer would lie at full length and observe by sets of lenses. The French army decided to adopt the first solution, that is, good protection and low flight, and from now on all the combat units will be armored. As to the unprotected ones, these will serve for training of pilots. The experiments which are to be made with new armored aeroplanes will be kept quite secret. It is surmised that the future aerial fleet will be made up of the following types of aeroplane: First, armored single-place flyers for artillery and cavalry scouting and for short scouting trips at the speed of 70 miles an hour. Second, the Etat-Major will make use of two-place scouting aeroplanes, also armored, and used for 60 miles an hour speeds. The third kind is an armored two-place with mitrailleuses and automatic guns, intended for pursuing the enemy's aeroplanes and airships and working at the speed of 70 miles an hour. Lastly, several-place types of heavy weight for a great range of flight and speed of 60 miles an hour, designed for special work.

A Radical Improvement in Cabling

Eliminating the Siphon Recorder

By Herbert T. Wade

THAT improved methods of working submarine cables are desirable may be appreciated from a statement authoritatively made that the number of cable messages sent throughout the world practically doubles itself every ten years, and the fact that recent changes of policy whereby deferred and other messages or cable letters are taken at reduced rates, are naturally leading to an increased use of the submarine telegraph in addition to the purely normal growth. A new method has been developed by which Morse signals may be sent through long submarine cables with some approach to the facility enjoyed in the transmission of the familiar dots and dashes on overland circuits. This new system promises to produce many radical changes in handling the ever-growing traffic now carried over the cables of the world.

By the new method re-transmission at the cable or land ends is obviated; the siphon recorder used since the days of Lord Kelvin gives place to an ordinary Morse recorder or sounder, with a corresponding increase of accuracy in transmission and saving of time in deciphering the received message; and a number of short cables can be linked up for direct working, while long land lines can be connected directly to a cable system, all messages being automatically relayed to practically any distance. The sending of signals over long cables can be effected by an ordinary telegrapher with a single Morse key instead of the double key of manual cable working, while a Wheatstone or other similar automatic transmitter may be introduced in case increased speed is desired. Consequently the new method establishes uniformity of operation between land and submarine lines and makes possible the fullest and most rapid interchange of traffic.

The invention resulting in these innovations came as the result of many years of experimentation on the part of John Gott of Hove, Sussex, England, chief electrician and consulting engineer of the Commercial Cable Company. In addition to daily use between London and New York special demonstrations have been made of direct communication between San Francisco and London, as well as between the latter city and Montreal, Toronto, Winnipeg, Victoria, and Bamfield, B. C., on the coast of Vancouver. Although the new method is one of extreme simplicity and requires no other apparatus or instruments than may be found at any cable terminal or testing station, it affords the solution of a problem that has held the attention of cable electricians for many years.

Hitherto even using the most sensitive instruments it has not been possible with a long cable so to interrupt the electric current as to form signal impulses of greater or less length such as the dash and the dot, but it has been found necessary to reverse the current and distinguish the two elements of the signals by its direction. Thus in ordinary cable working the letter *e*, indicated in the Morse code by a dot, would be signified by a + impulse, while *t*, represented by a dash, would be a — impulse, the galvanometer or siphon recorder at the receiving station indicating such impulses by an appropriate deflection of mirror or moving coil in one direction or the other. This of course would be in response to the signals of the sending operator made by depressing one or the other of two levers of the transmitting key, depending whether he wished to join the positive pole of the battery to the cable and the negative to the earth or *vice versa*.

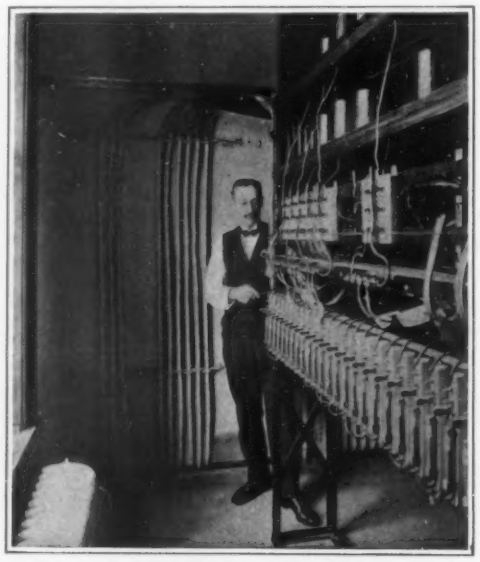
As in the case of the land telegraph it is possible to send two messages in opposite directions over a sub-

Special cabinets containing the artificial cables used in duplex working.

These cabinets in a room maintained at constant temperature contain inductive resistances that reproduce the electrical properties of a cable. The open cabinet shows those used with the cable from New York to the Azores. Other cabinets contain similar resistances for the various cables terminating at the Far Rockaway station.

John Gott of Hove, Sussex, England, chief electrician of the Commercial Cable Company.

Inventor of a successful method for transmitting signals of the Morse code, or dots and dashes, over long submarine cables, by the use of reversed currents, which secures uniformity of working with land lines and other connections, and which have been demonstrated by direct communication as far as between London and San Francisco.



Terminal room at the Commercial Cable Company's shore station at Far Rockaway.

The three cables to the left in the background are the subterranean land lines to New York city. Adjoining are the submarine cables that pass out through the sand dunes to the bed of the Atlantic Ocean. The operator is testing connections on the frame that carries switches, lightning arresters, terminals, and distributing system.

Sending dots and dashes through a cable by the Gott method.

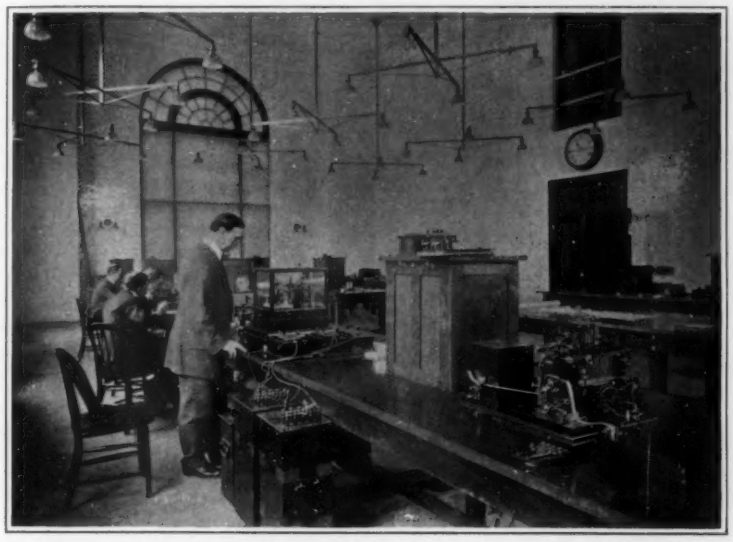
The operator is using an ordinary Morse key and a sounder is at his ear. The coil at the right is the special transformer and the polarized relay is contained in the cylindrical case between it and the key. Notice that all the instruments for use by the new method are of familiar type.

Operating room at Broad Street in New York city.

From this room in a building near Wall Street and at the very heart of the New York financial district, direct communication is maintained with London and the continent of Europe. The messages sent often involve millions of dollars daily. One cable is reserved exclusively for Stock Exchange business.

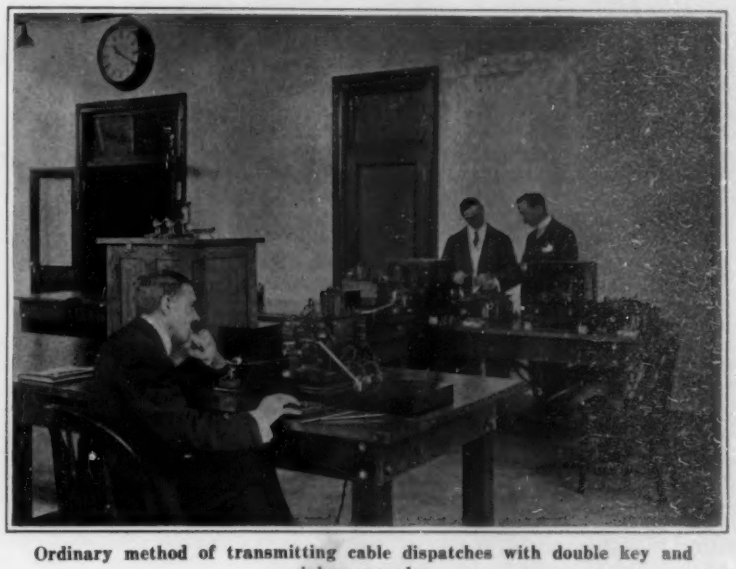
marine cable. It has been claimed that when a cable is worked under simplex conditions (i. e., sending messages in one direction only) the speed of working is slightly higher than that at which messages are sent in either direction when the cable is worked under duplex conditions. Nevertheless it is a fact that duplex working has more than doubled the carrying capacity of the cable, and it is now the approved method for all current passes to divide and flow through the arms *c* and *c* connecting with *A*, the cabel, and *b* an artificial cable having similar electrical properties as regards resistance, capacity, etc., to *A*. At *V* is a galvanometer or siphon recorder bridged across *A* and *b*, the entire bridge being balanced so that there is no difference of potential due to the battery at *L* and no disturbance can be caused by opening or closing the key at *d* in sending a same, of course, takes place at the original station.

Hitherto successful long distance cable working has involved the use of a reversing key to send two element signals by changing the direction of the current. Direct Morse, or dots and dashes, has never been found to work with success much over 500 miles, though it has been realized that the best results in speed and clearness could be obtained if it were possible to reverse



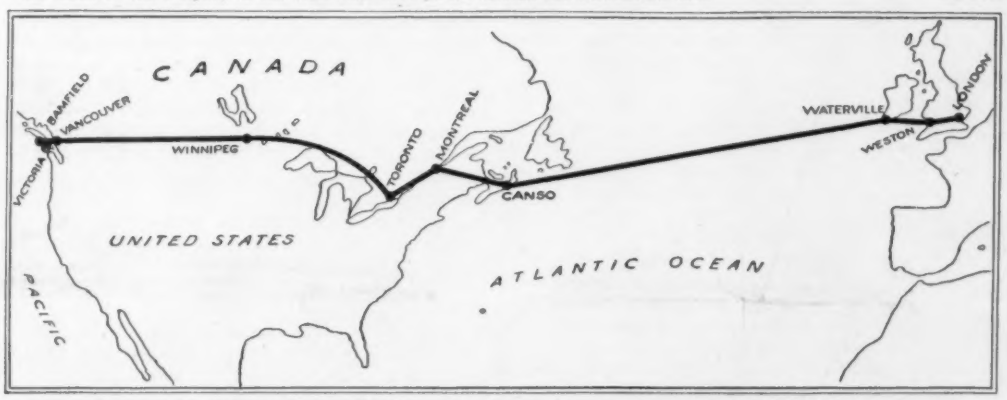
Operating room in new shore station at Far Rockaway, N. Y.—A model cable terminal.

All traffic of this company to and from New York passes through the instruments here.



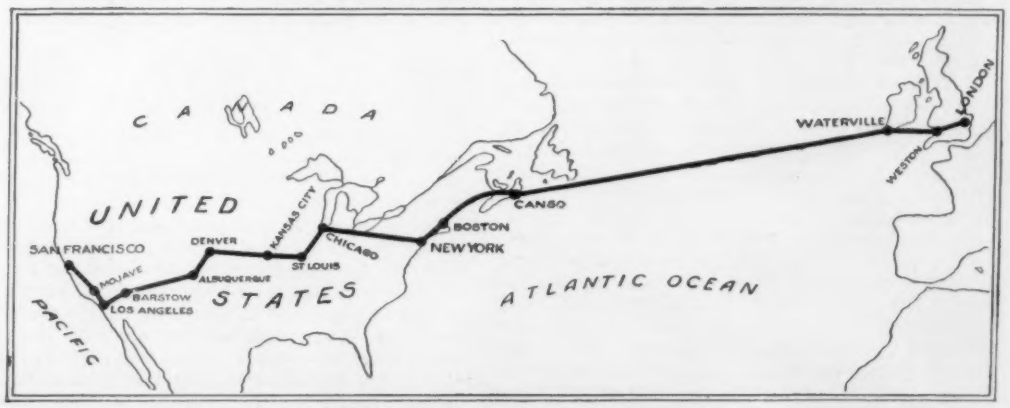
Ordinary method of transmitting cable dispatches with double key and siphon recorder.

An automatic relay is shown in the background.



Route of direct transmission of telegraphic signals from London to the Pacific Ocean.

Dots and dashes have been sent direct across an ocean and a continent, a distance of 6,477 miles. The long Atlantic cable from Canso to Waterville is worked by the Gott system as well as the cable from Ireland to Great Britain.



Map showing the route of the direct transmission of Morse signals from San Francisco to London.

Distance, San Francisco to London, 7,347 miles. Points where the message was automatically relayed are indicated.

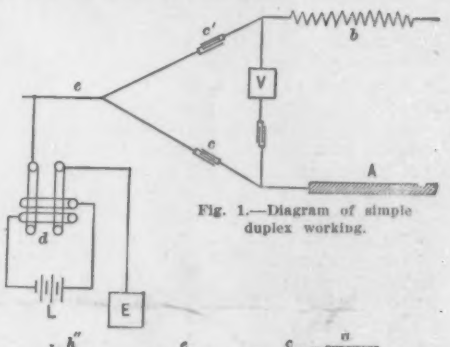


Fig. 1.—Diagram of simple duplex working.

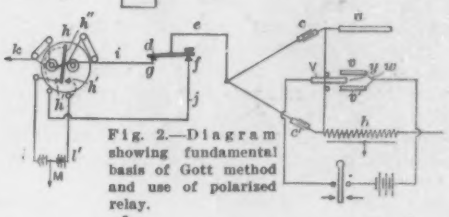


Fig. 2.—Diagram showing fundamental basis of Gott method and use of polarized relay.

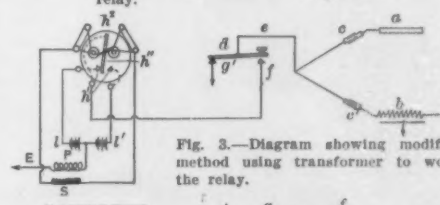


Fig. 3.—Diagram showing modified method using transformer to work the relay.

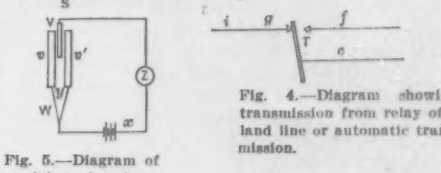
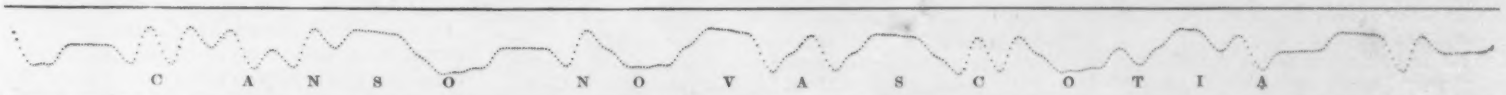
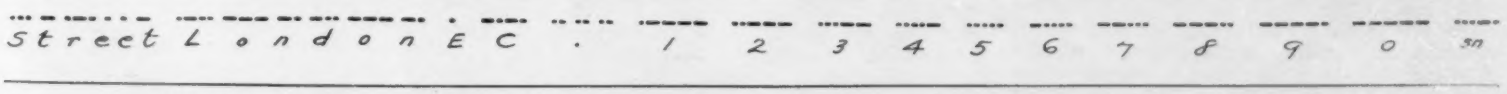


Fig. 4.—Diagram showing transmission from relay of a land line or automatic transmission.

Fig. 5.—Diagram of receiving instrument and circuit.



Section of tape with signals registered by siphon recorder and translation.



Record of a cable message sent across the Atlantic by the Gott method made on a paper strip of an ordinary Morse ink-register.

Note how clearly the dots and dashes came through.

busy lines, and of course to it the new Gott method may be readily applied. This is shown in the accompanying diagram (Fig. 1), which to one familiar with electricity will at once suggest the Wheatstone bridge. Here *L* is the battery, *d* a sending key or pole changing switch connecting at will either pole of the battery with the cable and grounding the opposite pole. Through *e* the signal. But at the opposite end of the line where the same arrangement prevails an electrical impulse or signal received will have the effect of adding to or subtracting from the potential on the cable side of the bridge and consequently act to destroy the balance of potential, causing the moving coil of the galvanometer or siphon recorder to be deflected appropriately. The the currents after each signal and then transform the resulting impulses into regular Morse. Various suggestions have been made for mechanical and other devices to effect this desired reversal of current in each successive impulse, but it has remained for Mr. Gott to work out the problem practically and electrically so that an ordinary Morse operator can send the conven-

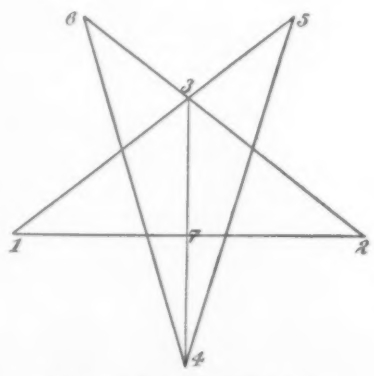
tional signals with the usual type of key, with the result that so far as the sender is concerned there are substituted the impulse signals by intervals of dots and dashes, while at the same time all of the advantages involved in the reversal of current for each successive signal are secured.

In its essence Mr. Gott's method is exceedingly simple. The change in direction of the current is effected after each signal by the use of a polarized relay through which the cable is discharged and the path of the current reversed for the next sending signal. The polarized relay may be of any type of suitable sensitiveness and resistance such as is employed on land lines. It consists of a permanent horseshoe magnet with one of its poles divided and formed into pole pieces around which are fitted coils of fine copper wire through which the current may pass. Between these pole pieces is poised a soft iron needle or tongue, free to move, but normally held at rest in a neutral position by the fact that it is attracted equally by both pole pieces. Now, if a current passes through the coils it will strengthen the magnetism in one of the two pole pieces, depending of course upon the direction of its flow, causing the arm or tongue to be attracted to one side or the other. In so moving it comes into contact with one or the other of two stops and completes a local circuit where the direction of the current depends upon the direction of the current flowing through the coils of the relay. The application of the polarized relay in the Gott method will appear on reference to the accompanying diagram (Fig. 2), which shows a cable arranged for duplex working. The cable itself is shown at *a* and the balancing or artificial cable having the same resistance and capacity required in duplex working is placed at *b* with its unconnected end grounded. Between the real and the artificial cable is inserted the receiving instrument *V*, and then after connecting with the condensers at *c* and *c'* the circuits unite at *e*, where the transmitting key *d* is placed. So far there is no variation from ordinary duplex working. The key however is arranged so as to connect *e* either with *g*, as when at rest or normal, or when depressed at *f* with *j*, as when sending a signal. Both of these connections lead to the polarized relay *h* and by tracing them out on the diagram the action will be apparent. Pressing down the key at *f* to make a dot or a dash the cable is put into connection with *j*, which in turn is connected with the movable tongue *h''*, and through it with one of the stops *h'*, each of which is connected with an opposite pole of the split battery at *l* and *l'* with an earth connection at *M*. Consequently depressing the key would charge the cable by connecting the condensers with the battery, and the polarity of the charge or current would depend upon which of the stops at *h'* the movable tongue *h''* was in contact with. Now permitting the key to return to its normal position establishing contact at *g* causes the cable to discharge through the polarized relay and the current flowing through the coils would send the moving tongue or arm from one stop at *h'* to the opposite so that where the + pole of the battery had been connected to the line, at the time of sending the next impulse or signal it would be the — pole. Thus every time the key is depressed the cable and condenser are charged with current of the opposite polarity, and this process with the discharge of the line between successive unit impulse signals goes on continuously, no two successive signals being of the same polarity. As the energy of the discharge from the cable is considerable, the resistance of the coils of the polarized relay does not figure and the cable is restored to a neutral condition so that good and rapid signaling is possible.

A modification in the sending method involves the use of a transformer in connection with the polarized relay as shown in a second diagram (Fig. 3) and in the photograph of the operator and instruments. In the diagram the condenser and cable are earthed directly at *g'* after each signal and while the key is open. A split battery is provided as before which is earthed at *B* through the primary coil *P* of the transformer. The coils of the polarized relay are in connection with the secondary of the transformer *S* and the contact point of the key *f* is connected through the movable tongue *h''* with the stops that in turn are connected with the split or double battery. The function of the transformer is to induce in the secondary coil, which is connected with the coils of the relay, a current that will send the tongue over against one of the stops and hold it there. Releasing the key will cause a current of opposite polarity to flow through the relay, sending the tongue over against the opposite stop so that when the key is next depressed the direction of the battery current to the line will be reversed from that of the previous impulse or signal. These reversals take place in regular sequence so that no two successive currents sent are of the same polarity. An advantage claimed for this method is that on making contact with the key to charge the cable the battery contact in the relay is reinforced at the moment the key is depressed, thus assuring perfect transmission. To substitute for the hand key the tongue of the relay of a land line is very simple as is shown in the diagram (Fig. 4), where *T* takes the place of the key *d*. Automatic transmission is also possible, using the punched paper and the familiar Wheatstone transmitter employed in high speed telegraphy. The Wheatstone transmitter takes the place of the key, the two upper contacts of the vibrating contact arms being used for this purpose and the reversing polarized relay employed as with the hand key.

To understand the receiving system the diagram (Fig. 5) should be examined in connection with that of the sending station. At *V*, where the siphon recorder ordinarily is placed, a similar instrument, but one provided with a contact making tongue attached to the moving coil, is used. This tongue or arm makes contact with either *v* or *v'*, depending upon the polarity of the current coming through the cable. These plates in the instrument are insulated at *y*, but are connected at *W* and are in circuit with the local battery *x*, and a sounder or recorder at *Z*, which however may be a relay or any desired instrument. While the contact piece at *V* will move from one side to the other depending upon the polarity of the arriving current, the effect on the local circuit will be the same in either case and the dot or dash is sounded or recorded just as if it were but a simple break and make of the circuit as in ordinary Morse working.

Now from this outline description it will be evident that these various arrangements can be combined practically indefinitely. Relays from land lines can be used to work sections of ocean cables, and the signals from one section may be transmitted to the next and finally to a relay working a land system of practically any length. Thus when the operator at San Francisco was communicating direct with London, his message was



Simple method of laying out a pentagram.

relayed across the United States by nine relays working over as many sections into the cable office in New York. Here the receiving relay automatically gave its message to the Gott arrangement and the electrical signal impulses were sent on their 1,000 mile journey to Canso, Nova Scotia, there to be received and automatically sent on the long section of 2,565 miles across the Atlantic to Weston Super Mare, England, where a similar retransmission through 146 miles of subterranean line took place to London and the message from the Pacific Coast was heard in that city with the familiar click as if it were but from Manchester. Clearly a point has now been reached where no limit can be put upon the interchange of traffic up to the capacity of the individual lines and cables making up a system. Scientifically the problem of Morse signals and reversed currents has been solved, but problems of traffic remain. A cable represents a costly investment and its use must be planned for a maximum of efficiency and a minimum of idleness whether it be for lack of business or waiting time to connect directly two distant points. The new method affords much greater facility of working, and while it will not phenomenally increase the actual speed of transmission yet it will, as in fact it has done, make submarine telegraphy more effective, accurate and uniform. Indeed with this and other inventions and instruments it may be said that cable working to-day is in a transitional period toward even greater efficiency, and that the day of the abandonment of the submarine telegraph with its lines of copper, guttapercha and steel armor for radio-communication is far distant.

International Exposition of Safety and Sanitation

RAILROADS covering nearly a billion locomotive miles are in the competition for the first award of the E. H. Harriman Memorial Medals, which will be made at the First International Exposition of Safety and Sanitation, to be held in New York city, December 11th to 20th, under the auspices of the American Museum of Safety.

The Jury of Award consists of Jane Addams, Vincent Astor, Mrs. August Belmont, Surgeon-General Rupert Blue, Mabel T. Boardman, George B. Cortelyou, John H. Finley, Irving Fisher, Elbert H. Gary, Prof. F. R. Hutton, Joseph Johnson, J. B. McCall, president of the National Electric Light Association; Dr. William H. Nichols, John H. Patterson, F. E. Rogers, B. B. Thayer, Lillian Wald, W. T. Wilson.

The Safety Exposition will be the occasion of the annual meeting and dinner of the American Museum of Safety which will be held at the Waldorf-Astoria on the evening of December 12th. One of the speakers will be President Arthur T. Hadley of Yale. All of the awards will be made on this occasion, including the Harriman Memorial Medals, the Safety Exposition Medals, and the annual medals of the American Museum of Safety, consisting of the SCIENTIFIC AMERICAN, the Travelers, the Seaman and Rathenau Medals.

To Strike the Pentagram

By John P. Robinson

WHILE there are various methods of striking the five-point star, the following one worked out partly by chance by the writer, while demonstrating certain attributes of Euclid's forty-seventh problem, is very simple and direct. Moreover, it offers an easy method of striking the star on a large scale, say for laying out a lawn bed, or other and larger applications, decorating, etc. It offers interesting suggestions as to the 3, 4, 5, and 8 relations, as one will agree upon working it out. All that is needed is a measuring stick, struck into 3, 4, 5, and 8 spaces. Try it at first with a common inched ruler.

Draw the base line, 1—2, eight inches long, marking off the center at four inches. At the center, strike a perpendicular line of six inches, three above, three below the horizontal line. You now have a cross, two arms having four-inch, and two three-inch dimensions. Call the top of the perpendicular No. 3, and the bottom, No. 4. Call the center No. 7.

Now, according to Euclid's problem, if 7—2 is four inches, and 7—3 three inches, 2—3 would be five inches. which is found to be the case. But the base line 1—2 is going to form the "peaks" of our five-point star, and these are just eight inches apart.

So now put your ruler on 2 and let its five-inch mark just touch No. 3, draw a straight line, beginning at 2, passing the point 3, and continue three inches more: this will make the line just eight inches long. Now place ruler on 1 and 3, and draw an eight-inch line also. Call the terminals of these new lines, 5 and 6. Draw a line from 5 to 4, one from 4 to 6, and you have the star.

The simplicity of this method should commend itself to those wishing to strike large star diagrams. With two common chalk lines for base and perpendicular, a rough pole as a measuring unit, you can easily strike a star having its base of two points eight times as long as the pole. The method is direct, much more so than striking from five points within a circle, especially when there is no easy method of quickly obtaining the 72-degree spacing of the circle except by trying five times around.

Is the Whale Disappearing?

THE fact that the whale is disappearing is pointed out by M. Ed. Perrier, head of the Paris Natural History Museum. Several species will probably soon be lost on account of the very active hunting being carried on at present. No less than thirty Norwegian companies are engaged in this work off the western coast of Africa, and on the eastern coast in the Mozambique region. The danger is as great from English enterprises. This account of the future extinction of the whale led the Academy to pass resolutions recommending the interest of the government in the matter and calling for an international commission.

The Current Supplement

THIS week's issue of the SCIENTIFIC AMERICAN SUPPLEMENT brings complete tables of the armored ships of our Navy, showing their principal dimensions, date of launch, number of guns, speed, etc. The tables are prefaced by some introductory remarks, which we owe to the pen of a naval expert.—Prof. Charles L. Parsons, Chief of the Division of Mineral Technology, Bureau of Mines, reports in detail on the radium resources of this country, which seems destined to become one of the principal producers of that ultra-precious material. —John J. Ide gives a brief description of the latest military type Borel monoplane.—Dr. Geoffrey Martin contributes an article on the production of pyrophoric alloys used in gas, cigarette lighters, etc.—Irving C. Allen writes on "Heavy Oil as Fuel for Internal Combustion Engines."—P. S. Millar, in an article on "Some Phases of the Illumination of Interiors," gives illustrated demonstrations of lighting effects produced by different sources under different circumstances.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Abuse of Carbon Copies

To the Editor of the SCIENTIFIC AMERICAN:

Not the least of the advantages which the modern method of typewriting offers over the old process of writing by hand, is the great ease with which a number of exact copies of the matter can be prepared at one operation. No one could possibly find fault with the common practice of this method, so long as it is not abused. One or two carbon copies can, with proper precautions, be made almost as legible as the original. Furthermore, if an additional number of copies are filed for one's own use in an emergency, in many cases the requirement of ready legibility may legitimately be allowed to fall somewhat into the background. But the practice, unfortunately somewhat widespread, of sending out in the regular course of business, documents the reading of which is an excessively severe task on the eyes, cannot be too strongly condemned. Will you permit me, through your columns, to put on record a protest against this practice? There is an easy remedy against it. Return all such defective carbons to the sender with the request for a readable copy. A glance at the matter received will suffice to determine whether the importance of the document is such as to induce the recipient to make an exception to his rule, but I venture to predict that the occasion will not frequently arise. A person who has anything of value to communicate will in most cases have the judgment and good taste to present it in respectable garb.

S. M. GRIDLEY.

[We take pleasure in publishing Mr. Gridley's letter. As editors, we have only too frequent occasion to make observations similar to his, and we can fully indorse him on every point.—EDITOR.]

An Aerial Maneuver

To the Editor of the SCIENTIFIC AMERICAN:

The San Fernando Valley is a level plain, oblong in shape, perhaps 10 miles wide by 30 miles in length from southeast to northwest, situated near Los Angeles and almost surrounded by high hills on the south and the Sierra Madre Mountains on the north, back of which is the Mojave desert. A peculiarity of this country is the almost total absence of what are known as turkey buzzards. On September 30th last, at about 4 P. M., I noticed an immense flock of buzzards circling around over the extreme south side of the valley, near the Cahmuga Pass, which leads into the city. The flock contained probably five hundred birds, and most of them, if not all, were turning from right to left and mounting higher at every round. As the column mounted higher it was continually augmented by birds coming from every direction, singly, in pairs, and flocks of various numbers to perhaps twenty, which promptly took their places in the column, which finally reached to a considerable height, probably three thousand feet. As soon as this height was attained the birds "volplaned" to the southwest, the nearest point to the coast, about 20 miles. This performance continued until the last bird was sailing away toward the sea. The above incident did not last longer than 30 minutes, but there were thousands of birds that left in the flight. They were probably migrating, but the query is, Where did they come from, and how did they know the date and place to meet and make the start?

Lankesshire, Cal. W. H. WEDDINGTON.

A Mr. Frank Young was present and saw the above, and will attest to the truth of the statement.

W. H. W.

A Plea for the Fox and His Fellows

To the Editor of the SCIENTIFIC AMERICAN:

You have been exceedingly generous in granting space for reference to the need of a humane trap. All lovers of animals must appreciate this. The Massachusetts Society for the Prevention of Cruelty to Animals certainly does. We have been doing what we could, and with some success, to secure legislation against the old-fashioned steel trap, with its possibilities of torture for the victim caught. The question has many sides to it, as some of your correspondents have discovered.

For the benefit of one of them I would like to call attention to John F. Draughon's "Fur Bearing Animals the Farmer's Friends." He says, in substance, the United States Department of Agriculture states that eighty million dollars' worth of damage is done each year to crops and fruit and forest trees by field mice, ground squirrels, moles, pocket gophers, and grasshoppers, and that these pests constitute from eighty to ninety per cent of the food of foxes and other fur-bearing animals, such as wolves, lynxes, badgers, raccoons, opossums, skunks, minks, weasels, and shrews. The warning, therefore, is given by the Department that unless a check is put upon the killing of foxes, skunks, raccoons, and the like, the farmer will continually find it harder to reap the reward of his toil. Even if occasionally a chicken is taken from the hen-yard by fox or skunk, the assurance is given that the farmer might better far pay this toll than kill the robber. Mr. Draughon is regarded in Tennessee as an authority on foxes. FRANCIS H. ROWLEY, *President.*

Boston, Mass.

The Ten Most Needed Inventions

To the Editor of the SCIENTIFIC AMERICAN:

A correspondent asks, What are the ten most needed inventions? Allow me to suggest the ten following: 1. A practical substitute for lead for use in secondary or so-called storage batteries. 2. Automatic stoking device, which will do the work as well as human hands. 3. Substitute for the wasteful wooden tie used on railroads. 4. Reduction gear and reversing device for steam turbines. 5. A commercially practical method of fixing atmospheric nitrogen. 6. Some method of suspension or spring wheel which will do away with the necessity of using pneumatic tires on motor cars. 7. A substitute for gasoline for use in internal combustion engines. 8. An automatic stabilizer for aeroplanes. 9. Method for delivering the energy in coal directly as electricity with the interposition of steam engine and dynamo. 10. The discovery of the secret of the firefly and its application to the production of artificial light.

New York city. ALBERT R. GALLATIN.

The Most Needed Inventions

To the Editor of the SCIENTIFIC AMERICAN:

Noting a recent inquiry in your columns the writer suggests that an attempt to limit the most needed inventions to ten would appear to be absurd. One can think of more than that many offhand, as for instance:

1. An electric light as efficient as the motor.
2. A storage battery as cheap as dry cells, light, efficient, and foolproof.
3. A new product which will utilize or require the use of vast quantities of chlorine to advantage.
4. A wireless telephone which will cost no more and use no more power than the simple sets now used on short inter-communicating lines.
5. A glass or substitute therefor which will withstand strains without breaking, without losing the usual transparency.
6. An economical crude oil engine light enough and adapted for automobiles and similar service.
7. Cheap substitutes for leather and rubber which have the properties of the natural material and which can be made on a large scale at low cost.
8. A lifeboat which will not sink or capsize and which can be launched safely in a heavy sea.
9. Means to prevent railroad wrecks which will, within human error, prevent such wrecks entirely.
10. Real cures for consumption and cancer.
11. A detector for radio communication which without sacrificing the sensitiveness, rigidity, and practicability of present long distance types, will still be of itself, or in conjunction with a positive rapid relay mechanism, capable of automatically transmitting the received energy into loud or visible signals under all conditions met in practice.

And so the list might be continued. Many of the items are of course already receiving attention with encouraging results; certainly we shall see at least some of these problems solved and perfected. It would be interesting to note the individual opinions of several hundred readers engaged in the various arts and industries. Then, perhaps, it may please some to guess at the ten most urgent. PHILIP E. EDELMAN.

Minneapolis, Minn.

Just What is a Cyclecar?

To the Editor of the SCIENTIFIC AMERICAN:

This is in reference to the article on Cyclecars, appearing on page 265 of your issue of October 4th. After reading the statements contained in this article in regard to the American cyclecar, the question naturally arises, "Where does the *cyclecar* stop, and the *automobile* begin?" In other words, what is the distinction? Why is the vehicle shown, for instance, at the upper left hand corner of the above page any more a "development of the motorcycle" than it is a development of the automobile? It would be a good idea if you would publish a definition of "cyclecar" for the benefit of your readers. J. H. B.

Washington, D. C.

[Abroad, where cyclecars first saw the light of day, they were a development of the motorcycle, or rather from the motorcycle; they consisted, and still largely consist, essentially of motorcycle parts, and for a long time the Royal Automobile Club was hard put to it to find a class in which to place them. At length it was determined by the International Federation of Motorcycle Clubs to place cyclecars in two classes, both classes to consist of vehicles having either three or four wheels and for one or two passengers. The larger class includes vehicles with a maximum weight of 784 pounds and a maximum piston displacement of 1,100 cubic centimeters, the tires to measure 2⅜ inches in section; the smaller class to have a minimum weight of 330 pounds and a maximum weight of 660 pounds with a maximum piston displacement of 750 cubic centimeters, with tires measuring 2 1/16 inches in section; all vehicles must be equipped with a clutch and change speed gear. Hence, the foreign cyclecar conforms largely to these simple specifications. In America, manufacturers of so-called cyclecars have given no intimation of being bound by even these figures, and we find vehicles exceeding both weight and engine capacity unceremoniously termed cyclecars despite the fact that—in so far as the I. F. M. C. definition is concerned at least—they are little more than small editions of large automobiles, many of the attributes of which they retain. Strictly speaking, they are not cyclecars, as was made plain in the article to which you refer; they are developments of the automobile rather than of the motorcycle, though the fact remains that their inspiration sprang from the two-wheeled vehicle.—EDITOR.]

Expert Report on the Last Zeppelin Disaster

IN the issue of November 1st of the SCIENTIFIC AMERICAN the writer discussed the "Lessons of the Zeppelin Airship 'L. II.'" It is interesting to compare with the observations then made, the expert report of Dr. Eckener on the probable cause of the explosion of the ill-fated craft. From this report the following excerpts are quoted:

"There can be no doubt that at the moment of catching fire the craft was practically enveloped in a layer of explosive air-hydrogen mixture and that these gases were ignited in the forward engine car by a spark or the like. . . . In the engine car there ought to be no possibility of any explosive mixture of gases being present.

"Dr. Eckener further concludes that the catastrophe of the "L. II." was brought on by the peculiarities of the construction of the vessel. In point of fact the new type of the "L. II." was the subject of serious discussions between Count Zeppelin and his experts, as well as those of the navy, and it may be freely stated that Count Zeppelin did not regard this type as being quite as safe as his earlier constructions, and set out upon the building of the ship with a certain amount of hesitation, although the design of the ship was in other respects very excellent.

"Wherein lay the new features of the "L. II." as compared with the older types? Principally in respect to three points: A gangway was placed inside the ship, the cars were drawn up close to the balloon, and the forward engine car carrying two motors was provided with a large wind screen to protect the passengers from the rush of air. The question is, Which of these three factors caused the explosive gas mixture to enter into the engine car?

"As regards the first point, placing the gangways within the balloon, this in itself is not a serious matter. It is true that a temporary accumulation of gas at the top of the gangway may occur at the time of blowing off gas, but gas so escaping would not thereby be brought into the car.

"More danger must be seen in the second feature, the closer approximation of the car to the body of the balloon.

"But unquestionably the most fatal error in the construction was the provision of the screens. A dead space is formed behind these, in which air and hydrogen may accumulate. The catastrophe of the "L. II." can therefore be explained only as follows:

"The airship rising rapidly gave off a large quantity of gas. An explosive mixture was drawn into the forward engine car and was ignited by the flame of the carbureter or some other similar cause. Once this source of danger is realized, the remedy for it is not far to seek. Provision must once more be made as on former occasions for good ventilation over the engines, regardless of the comfort of the passengers. If this is properly attended to, future airships will be as safe from explosion as former models. Perhaps it will be as well to go a step further and to cause the escaping gases to leave the balloon at a point where they are not dangerous to it."

If the reader will refer back to article noted above, he will find that in all essentials this agrees with the expert opinion here quoted.

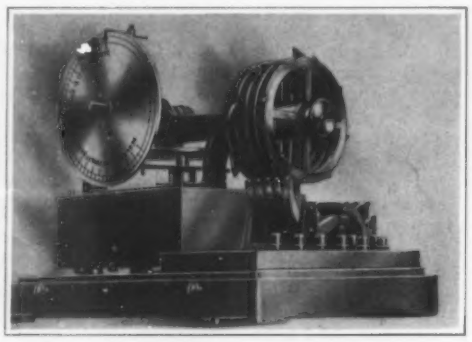
A Good Furniture Polish

A GOOD furniture polish, which is black and which will remain soft in the container, is made as follows: Three ounces of wax, two ounces of pearlash and six ounces of water are heated together, and when thoroughly mixed add four ounces of boiled oil and five ounces of turpentine. This should be poured in wide mouth containers, where it will keep indefinitely.

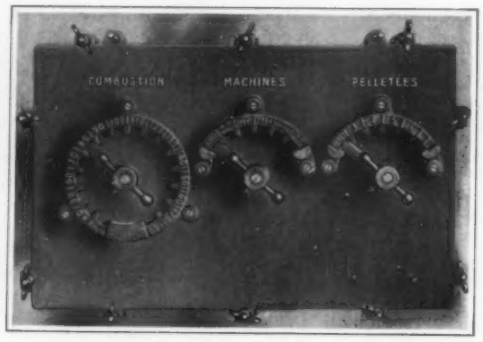
Electric Signal Method of Firing Navy Boilers

Automatic Indicator Tells When to Stoke the Furnaces and Amount of the Charge

THE Niclausse electrical signal method for furnace firing has proved such a success that the French navy is now adopting it as standard upon the battleships of the fleet which are operating by steam turbines, and it is also coming into use upon many other vessels. In the old method of directing the furnace firing the overseer in the furnace-room calls out the time and order for stoking the furnaces, and this is likely to make him neglect other duties such as observing the water level, coal conveying, ash emptying, etc.



A—The signal sender.



B—The three-switch order transmitter.

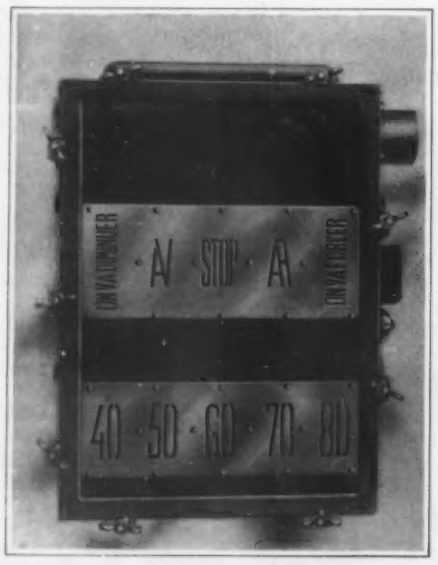
In the simplest form of the electrical apparatus the operation is as follows: An automatic signal sender is placed at the control bench of the engine-room and at the chief engineer's hand. This officer possesses a table showing the number of furnace charges per hour necessary to obtain the different rates of combustion per square foot of grate surface, and in consequence the different rates of steam production. For instance, should he need 15 charges per furnace per hour to keep up the required combustion, he sets the automatic signal sender for this figure, so that signals are sent accordingly to the furnace-room. The signal sender *A* is a simple device carrying a clockwork driven shaft with sets of disks on the end. Each disk has two projecting cams which work upon lever arms on the base, and the cam drives its lever arm so as to make an electric contact, there being thus two electric contacts per revolution of a disk. Our engraving shows four such disks, also an outer cam disk for ringing an electric bell. The engineer sets the speed by turning a numbered disk to 15 or other number of charges per hour, which acts on the mechanism. Thus the apparatus gives the needed signals to all four furnaces at the proper rate, without any more attention, by the use of a luminous indicator board. The latter is placed in the furnace quarters and consists of four luminous panels *C* mounted in an iron box, each panel being connected by wires to one of the disks of the sender. As disk No. 2 revolves, for instance, it makes an electric contact so as to light up the lamps behind panel No. 2, thus indicating "Charge 5 shovelfuls into furnace No. 2," and the electric bell rings at the same time. In the same way panels Nos. 3, 4, etc., are operated in turn, and thus all four furnaces are stoked in the proper order. The number of shovelfuls per charge is set once for all to 4, 5, 6, etc., by turning a button placed beside the number on the luminous board, and should there be differences in the grate surfaces these can be compensated in this way. Pilot lamps in the engineer's post enable him to see that all is working properly. The signal sender is all inclosed and can be set at once from the outside to any rate that the engineer may require for a given period of time, simply by turning the numbered disk so as to accelerate or diminish the rate of stoking.

Since the use of multi-tubular boilers, which are very sensitive to sudden changes in firing, the Navy Department has recognized the necessity of using a methodical stoking system, as besides giving a better yield, it partly prevents the volumes of smoke which show the presence of the vessel to the enemy. On board the "Ernest Renan," which possesses 42 boilers and 8 stoking passages, the old method of conducting the furnace firing by clock, which was the only means then used, became almost useless. In fact, the chief engineer in the engine-room could only communicate by speaking tube with the furnace quarters, and this resulted in errors of transmission of the number of charges to be adopted and hence much irregularity in operation. Then the Niclausse system was put in, and it rendered such good service that the personnel on board pronounced unanimously in its favor, so that it was retained in this vessel and soon afterward installed also upon the "Patrie" and at a later date upon other battleships. Each of the furnace passages is provided with one luminous indicator, and the engineer can turn his disk so as to instantly change the rate of combustion of all the furnaces and is thus master of the whole operation. Besides, the system allowed of eliminating 24 stokers, as was shown during the first tests, and moreover the greater regularity of combustion resulted in a lessening of coal consumption, so that now this was only 707 grammes (25 ounces) per horse-power-hour. Suppression of safety-valve lifting almost entirely, of bringing

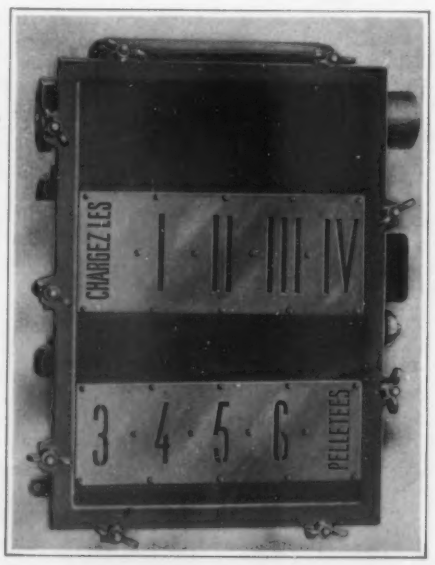
C—Luminous indicator in the furnace-room.

over of water, and of flames from the smokestack which are an inevitable consequence of bad firing, were noticed in this case.

Upon the appearance of 23,000-ton battleships it was feared for a time that the maneuvers would not be as rapidly carried out with steam turbines as upon engine-equipped vessels, and a remedy was sought in making a closer connection between boilers and turbines than before, especially as concerns the reverse drive. This led to the use of a somewhat more elaborate form of apparatus which we illustrate, the object being to send more complete signals to the furnace quarters. The same signal sender is used as before, and to it is added an "order transmitter" *B* with three handles working upon numbers so as to give the following indications upon luminous panels; first the indications as to speed of the engines (five signals), "speed to be accelerated," "stop," "forward," "reverse," and "speed to be diminished;" second, combustion figures showing the combustion rate per square meter of grate surface and per hour from 40 up to 180 kilogrammes if need be; third, the number of shovelfuls for the furnace charging. This will be clearly seen upon the two luminous boards, the first board *D* containing in the top range the five speed signals just named, while the lower range shows the combustion figures 40 to 80. An electric bell is also used. Above 80 the number is obtained by using two figures and adding them, for simplicity. The second luminous board *E* is a modification of the first-mentioned one, and indicates "charge furnace Nos. I, II, etc., with 3, 4, 5 or 6 shovelfuls," as the case may be. All these indications are indispensable, for it is not enough to use the first-mentioned device alone for the furnace firing in this latter case, for even though the stokers obey the firing signals, they only perceive after a certain time that the firing rate is becoming more rapid or slowing up, and it is preferable to call their attention at once to changes which are being made in the firing rates, so that from the first moment they can look after the fires and vary the draught either by working at the ash pit or by attending to blowers or air compressors. The chief engineer therefore operates the rate disk of the signal sender and also the three handles of the second device or "order transmitter." The three dials here correspond respectively to combustion figures (40 to 80, etc.); second, speed figures, also stop or reverse; third, number of shovelfuls per furnace charge. As to the last, it is seen that the engineer can vary the number of shovelfuls at any time, while in the last, it is seen that the engineer can vary the the three handles of the order transmitter, the first two work together with the first luminous board, while the third (shovelfuls) works upon the lower range of figures in the second board (3, 4, 5, 6). The clockwork signal senders work with the upper range of the second board to show the numbers for the furnaces (I, II, etc.), and to ring the electric bell, as before. With the present simple and effective apparatus no false maneuver can be made, and each change in operating the vessel is made to give the corresponding change in the whole of the furnace quarters, instantly showing what is to be done so that the new conditions are met, without abrupt changes. At present the personnel has become so accustomed to the new method that no change would now be welcomed. To sum up, the apparatus gives the chief engineer practical means for regulating the furnace firing in accord with the speed of the engines; it renders methodical firing easy to the stokers on account of the clear and precise indications it gives; the engineer is now freed from watching the clock to regulate the firing and can give best attention to the other points. The method also secures an appreciable economy in combustible and gives greater regularity in the running of the engines. Furnace firing takes place under better conditions of fuel burning and this avoids some of the well known drawbacks of the former method; and, finally, the boilers will last a decidedly longer period of time on account of the satisfactory absence of sudden heat changes.



D—The luminous board in first apparatus.



E—Luminous board No. 2, second apparatus.

The Continuous Rail in the United States

A Machine That Crimps a Head Section on a Rail

EVER since the flange was put upon the car wheel instead of upon the rail, engineers have sought to avoid the useless scrapping of the whole rail, when only 5 per cent to 8 per cent of its upper surface has been worn away.

When rails began to be laid in city streets, about eighty years ago, it became apparent that the wearing out of this small proportion of the rail would necessitate, not only the renewal of the whole rail, but the entire reconstruction of the track. Inventors and engineers devised compound rails with the object of avoiding these costly renewals and hundreds of such rails were patented. The difficulty, which was never until quite recently overcome, was in attaching the head or wearing surface of the rail to the base, or supporting members, so that the two members would hold fast together and withstand the vibration caused by the passing wheels.

Progress in rail-making and other arts, has made possible the system recently introduced into this country by a manufacturing company, after it had been tried out in England and France, where it is known as the "Romapac" rail. During the years 1911 and 1912, four miles of this system of construction were successfully laid in the city of Chicago.

The rails were made of high carbon open-hearth steel. The head sections were applied to the base sections so as to stagger the joints, and after being placed in position in the street, the flanges of the head section were crimped under the false head of the base section in such a manner as to convert these flanges into springs having a grip of thirty-six tons to the running foot, which grip would easily withstand the stresses developed by the heaviest electric locomotive. Only open-hearth steel could be used for the head section, as Bessemer is not sufficiently homogeneous and the larger percentage of phosphorous present in high-carbon Bessemer steel makes it "cold short" and would cause the flanges to fracture during the crimping.

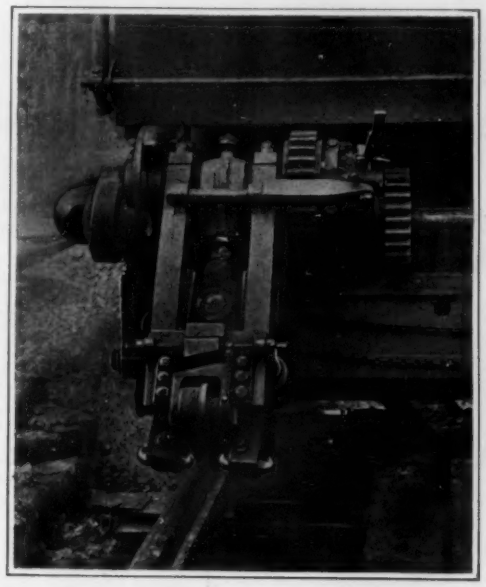
The latest development in electric motors had to be utilized to develop the power necessary to perform this operation with satisfactory speed, and the highest quality of chrome-vanadium steel had to be used in constructing parts of the machinery.

In the process of manufacture the head section of the continuous rail passes through the mill in such a manner that it is more homogeneous, more close-grained, and of greater electrical conductivity, than rails rolled in the ordinary way. It therefore exactly complies with the conditions favored by the Committee on Standard Rail Sections, A. S. C. E., 1893, who reported that "the grain, or fineness, of hot-rolled steel is governed by the work applied to it as its heat decreases," and "we are convinced that the wearing qualities of rails depend on the closeness of the grain of the steel in their heads."

Tests made by the railway officials in Chicago show that the fine grained continuous rail head has over 70 per cent greater electrical conductivity than ordinary rail metal.

The staggered joints and the spring grip of the head flanges, make it practicable to use the rails as a negative return, and each Chicago rail was found, after being laid in the track without any welded or other joint, to be equivalent to 2,290,000 C. M. copper. The value of this copper, laid in the street, may be taken at 70 cents per running foot per million C. M., so that in addition to saving the entire expense of bonding, there is a saving in copper cables which might amount in extreme cases to $16,926 per mile of single track (2 rails).

The area of electrical contact where the head of the continuous rail is crimped to the base is (between the joint of the base and the joint of the head), over thirty times the area of the cross section of the whole rail, so that any loss of current at the joints is practically negligible. The saving in maintenance due to the elimination of damaged joints would vary with every system, but may be taken roughly as 60 per cent of the total cost of track maintenance.



Mechanism for taking off worn rail faces from a track.

When the continuous rail is worn out and has to be renewed, the saving in reconstruction in paved city streets ranges from $10,000 to $15,000 per mile of single track. In Chicago the amount of saving is estimated to be $11,500. In another western city the saving is estimated at $15,330, as per details given below:

Saving in rails	$3,536
" " concrete	2,640
" " labor	4,224
" " ties	2,295
" " tie-rods	270
" " tie-plates	540
" " screw-spikes	216
" " stone ballast	979
" " bonding	630
	$15,330

The track laid in England in 1906 is still in operation and the joints show no sign of cupping, although it has been subjected to very heavy traffic, so that wear and tear on the rolling stock from this cause is eliminated. In laying this track, care was taken that no head rails with upward kinks at the joints were placed in the track, and it is essential wherever the joints of the head section are uneven, that they be ground true before the cars are run over the track. It is to be further noted that no corrugation has developed on this track, although there is a great deal of corrugation in adjacent tracks.

Similar rails were laid on a curve in the Paris underground railway in a manner to thoroughly test the grip of the head rail flanges, where they stood the test with entire success.

Although the success of this system of construction has up to the present time been demonstrated only on street railways, it is advocated for use in main line railway construction as offering a solution to the problems connected with defective rails, which annually cause some two hundred and forty accidents on steam railways in this country.

It is evident that a defect or fracture in either the base or the head section of a continuous rail would simply result in another joint in the broken section, which would remain firmly held together by the sound section to which it is crimped.

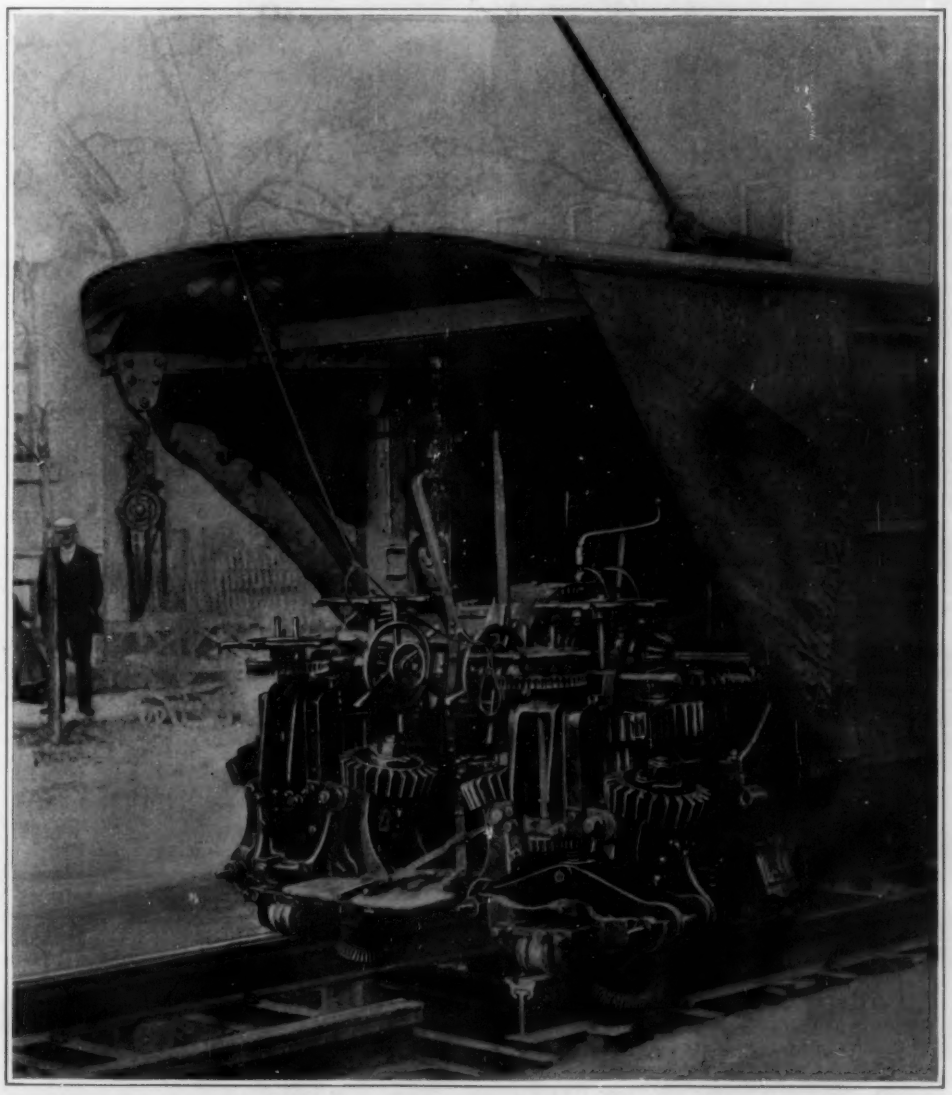
Rolled High-manganese Continuous Rails.

In adapting the continuous rail for underground railways, the advantages of staggering the joints of the head relative to the base sections, of the true alignment of meeting rails, of smooth running, and of the absence of hammering joints and fractured rails, are all retained.

The rails are supplied in the usual lengths and composed of an open-hearth steel base rail, on to the top of which is crimped a rolled high-maganese steel head or running rail of equal length, but so crimped that one end projects four inches beyond the end of the base rail which projects an equal distance beyond the head rail at the other end, forming when the rails are laid in the track staggered, or overlapping joints.

The rails are fished together with an improved combined splice and soleplate placed center with the joint in the rails. Acting in conjunction with the

(Continued on page 402.)



View of the working end of the electric rail crimping machine.

Diver with salvage outfit appearing at the surface.

Rescue Apparatus for the Crew of a Wrecked Submarine

By Dr. Alfred Gradenwitz

Diving tests performed with the salvage outfit.

THERE are mainly three possibilities liable to result in the wrecking of submarines, viz.: 1. Springing a leak as a consequence of collision with another vessel or with the ground; 2, running aground by false maneuvers or failure of the engine; and 3, fire or explosion.

Most of the fourteen submarine catastrophies on record, all of which—with the exception of that of the German submarine "U3"—have resulted in heavy losses of human lives, are to be ascribed to causes 1 and 2, and only those due to cause 2 in the end may be reduced to a minimum. Existing safeguards against the causes coming under 3 are at present so highly developed that catastrophies ascribable to them will always be of exceptional occurrence. On the other hand, the serious danger resulting from the first two causes is evident, and it is proposed in the following to discuss the means available for facing it. The salvage apparatus at present supplied by the oxygen industry may be divided into two groups, viz.: 1, apparatus and devices for purifying the air (supply of oxygen and absorption of carbonic acid and exhaled gases); 2, emerging apparatus allowing the crew to leave a wrecked submarine.

The apparatus for the purifying of air are mainly characteristic of German submarines. The air exhaled by the men is regenerated from a store of compressed oxygen kept on board, its carbonic acid being absorbed by potash cartridges. This regeneration continues without interruption until the available store of potash cartridges is exhausted. At moments of extreme distress and in the event of sudden failure of the lighting plant, the crew will find at certain known places emergency cartridges for immediate oxygen respiration.

The installations for use in purifying air on submarines have already proved of inestimable value in an emergency which would otherwise have meant loss of life. The twenty-seven men rescued from the German submarine "U3," which on January 16th, 1911, foundered in Kiel harbor, are indebted for their lives to the regeneration of air with the potash cartridges. Apparatus belonging to group 2 (emerging apparatus) form part of the salvage material of the German and some foreign submarine fleets. England has adopted pot-shaped diving helmets filled with air which are thrown by the men over their head, shoulders, and breast, thus taking those equipped with the apparatus up to the surface. The German submarines are equipped with a so-called "diver salvage" outfit, comprising an emerging and a breathing apparatus. Comprehensive tests having shown its suitability, several foreign navies have adopted the same system.

The "diver salvage" outfit has to perform three main tasks: It is intended under variable water pressures to warrant a satisfactory respiration. It is to endow the man with sufficient buoyancy for reaching, as it were automatically, the surface of the water, while allowing him to control his buoyancy, so that he may leave even considerable depths (up to 200 feet) without any serious trouble. The apparatus is also designed to keep the man for a considerable time floating at the water surface.

The whole outfit, when out of use, forms a little parcel easy to stow away. Its weight is about 6 kilogrammes, to which a counterpoise 5.5 kilogrammes in weight is added. The apparatus is put on like a waistcoat and is ready for operation in a few seconds, without interfering with the movements of the body and head in the air or water. The ears remain uncovered, and the eyes can be protected by a pair of diver's goggles. The apparatus imparts to the man and his outfit sufficient buoyancy even in the event of its air being inactive. The man equipped with the outfit can breathe one hour or breathe *and* work half an hour in vitiated air (in the submarine), below and in water, as well as on land if he is again to dive below water or into vitiated air. The buoyancy of the apparatus at the surface lasts many hours without limiting in any way the sensitiveness of the man.

On account of these valuable features, the apparatus would seem to be suitable not only for rescue work in submarines, but at the same time as a useful adjunct for engineers called upon to work under water or in cavities filled with deleterious gases.

The "diver salvage" apparatus is based on the action of potash cartridges used so successfully for mining salvage work. The outfit comprises a self-contained oxygen breathing contrivance with automatic air regeneration and a swimming vest on which the various parts of the apparatus are fixed in such a way as to take up immediately their proper position when the vest has been put on. The breathing apparatus proper comprises the oxygen cylinder, the cartridge for absorbing the carbonic acid, the breathing bag carried on the back, the mouthpiece for mouth respiration, the nose clamp and some flexible connection tubes. The mouthpiece comprises two breathing valves insuring a continual circulation of air from the breathing bag through the potash cartridge, so that the air may return into the breathing bag in a purified condition. The exhaled carbonic acid is absorbed completely in the potash cartridge. The oxygen required for respiration is derived from the oxygen cylinder, and a store of compressed air serves to compensate any difference in pressure on emerging from considerable depths, any air submitted to surplus pressure escaping through ingeniously constructed valves.

Salvage outfit for submarines seen from the front.

Diver's salvage outfit seen from the back.

In the following it will be supposed that a submarine, on account of partial water invasion and the impossibility to emerge to the surface, is lying at the bottom at a depth of say 100 feet. The transversal bulkheads having allowed the endangered compartment to be left, the crew have gathered in the central compartment, where the air regenerator of the submarine will for some days to come exclude any danger of suffocation. Should, however, the periodical air analyses have shown the vivifying effects of the regenerator to be doomed to exhaustion before the rescue work commenced from the surface may have advanced to the foundered vessel, the critical moment has come to leave the submarine. It may be said that the crew immediately after the occurrence of the accident had been ordered to equip themselves with the rescue outfit, with the handling of which they are familiar through previous training. After fixing the order in which the men have to emerge to the surface, all preparations are made for leaving the wreck. Since the latter is submitted to an outside pressure of 3 atmospheres (45 pounds per square inch), escaping is only possible after compensating the pressure in the interior of the submarine, which can only be done by allowing it to be flooded with water.

After taking a deep breath, the men put the mouthpiece into their mouths, locking the mouthpiece tap and putting on the nose clamp. The valve of the oxygen cylinder is kept open until the breathing bag is placed in position on the back. Everything is now ready for starting on the last voyage which affords some chance at least of salvage. The moment no doubt is critical. After loosening the bottom valves of the wreck, the water with a gurgling noise rushes into the compartment, surrounding the feet of those waiting to be rescued, creeping up along their bodies and closing above their heads. However, in spite of the seriousness of the situation the men are for some time at least protected by life-giving oxygen. The pressure on the ears after some energetic draughts is relieved. While the right hand is applied to the valve of the oxygen cylinder, disengaging at intervals the supply of vital air, the left hand encompasses the valve of the compressed air cylinder, thus compensating any pressure difference in the apparatus. After some minutes the whole compartment, apart from a layer of compressed gases, is filled with water. All hatches having been opened, a weird green light penetrates into those depths, if the sun be shining above the waves. One after the other, the men now emerge from the hatches, seize the cable of the emerging buoy and the anchor ropes, and rise swiftly toward the surface. The air expanded in the apparatus escapes with a bubbling noise through an extremely sensitive compensation valve. The surplus pressure, which otherwise would weigh heavily on the cheeks, throw the mouthpiece out of the mouth and crush the man, is never felt in a really disturbing manner. After reaching a depth of say 50 feet, the man stops for about 2 minutes and tries to animate his blood circulation by agitating his legs, while allowing any stagnating nitrogen to escape. After a further pause of 5 minutes at a depth of 20 feet, the final ascent to the light and to the comrades engaged in the salvage work is accomplished. A safely working arrangement enables the man to throw off the breathing apparatus on reaching the surface; the upper part of his body, however, is protected by the swimming vest, until he leaves the water.

How Mold Fungi Live

CARRYING out his researches on the nutrition of mold fungi, A. Kossowicz showed that certain fungi of lower orders, especially the aspergillus, penicillum, mucor and others, are able to assimilate urea and uric acid and to produce ammonia in consequence. Lately he finds that different species act in the same way in regard to glycocol and hippuric acid, and on the other hand he notes that some of these fungi are also able to utilize the nitrites alone as a source of nitrogen. He even finds some specimens which develop very well in a glucose medium containing one per cent nitrite of potassium, thus giving rise to ammonia. Together with Von Groller, he studies cultures of numerous spores and bacteria in mediums containing sulpho-cyanic compounds, and it appears that some of these organisms are able to use such compounds as a source of sulphur and nitrogen, but do not find in them all the carbon or nitrogen required.

It is claimed that some of the eucalyptus of Australia are taller than the California redwoods, which are commonly considered the highest trees in the world.

An Exerciser that Lights the Home

A PARIS inventor has combined a bicycle with a small dynamo and storage battery so that the energy which the human motor produces when working the exerciser, instead of going to waste, is stored up in the accumulator. The idea is a simple one, as will be observed, and in case the premises are not wired up for current the device may prove a most useful one for many purposes. In this way it is possible to use one or several small lamps for domestic lighting, so that the work done with the exerciser during the daytime can be taken advantage of in the evening. One point to be noticed is that the fact of using electric lamps gives a stimulus to the use of the machine for the purpose of exercise and is apt to prevent the daily exercise from being neglected, now that it becomes necessary. The present machine is designed to work several lamps with an hour's pedaling, and when there are several members of the family to use it, the number of lamps and the amount of light to be had from the device of course increases accordingly. Two sizes of machine are used, one to work with a storage battery of 12 volts and 12 amperes, this being intended for the use of not overly strong persons, while the second size is intended for use with a 12-volt and 25-ampere battery and serves for persons with strong muscles.

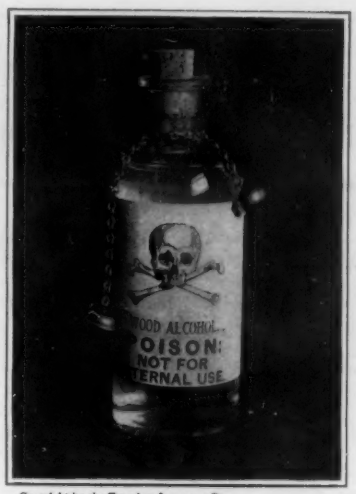
The Chagres River in Flood

AS we have explained from time to time in these columns the Chagres River, which so long proved a menace to the Panama Canal, has been tamed and put to useful work by the building of the Gatun dam and power plant. Some idea of the tremendous power of this stream when in flood may be gained from the accompanying photograph, which shows the waters pouring over the spillway before it was completed. Now that the dam is finished, the mad capers of this wild torrent have been overcome. The river, which was known to rise 25 feet in as many hours, is now checked by the hill of clay that closes the Gatun Valley, forming a lake so large that the mighty floods of the past now represent a rise measurable in fractions of an inch. The waters may be let off as desired and a large part of them is used to generate electricity for light and power throughout the Canal Zone.

A Motor-driven Road Builder

A SELF-PROPELLED road building machine has been tested in Los Angeles with results that are said to be highly satisfactory from the standpoints of efficiency and economy. The engine which does all the work is a six-cylinder, distillate burning gas engine of 80 horse-power, which operates a series of bucket chains that dig the soil to any depth down to eighteen inches, and the tooth-armed buckets are so powerful that they will cut through a finished pavement if it be desired to rebuild old streets. The earth is picked up by these buckets, carried to a mixer in the body of the machine and thoroughly combined with any desired binder, hot asphaltum or crude oil, and is then spread evenly and rolled, all in one operation. A trailer containing the binder follows the machine, and it is necessary to have a string of them in readiness as the device operates with great speed. The earth is dug up, mixed, relaid and rolled at the rate of fifty square feet a minute for an eight-inch depth of asphalt pavement. A very advantageous feature of this method of mixing is that it is uniform from base to surface, so that there is no danger of the surface's buckling. Of course where the mixture includes crushed rock, it is necessary to spread this material before the machine. The chains of buckets are independent of each other, and as each has a width of six inches, it is possible to form various combinations for roads of different widths. The maximum number is eleven. Thus, for a twenty-foot roadway, the proper combination would be ten chains of six-inch buckets, so that four operations over the road would combine to make the required twenty feet of width. The machine was designed by John Murray, a local inventor and road builder, and cost about $30,000. It is a huge machine with a length of twenty-five feet, but a smaller and less expensive model is projected.

Storing up energy on the exerciser.



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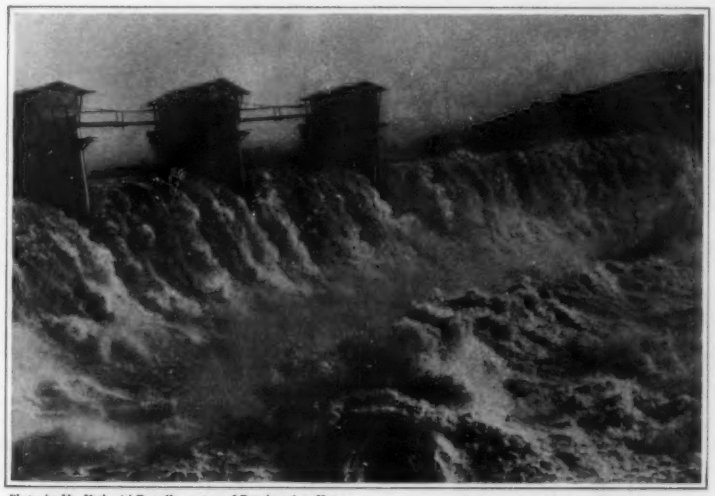
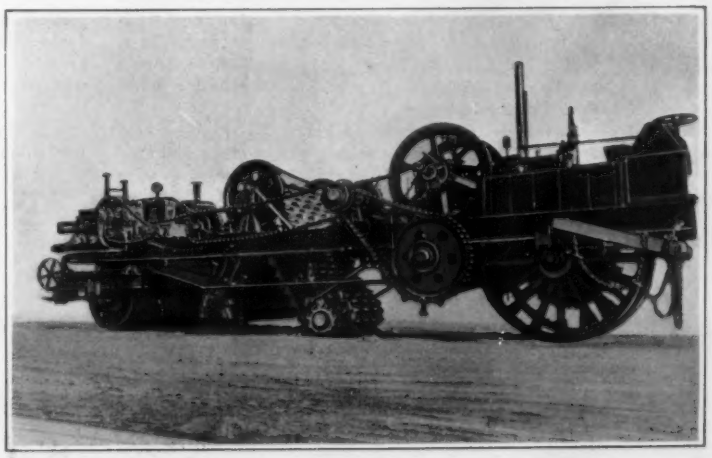
Bells give warning in the dark.

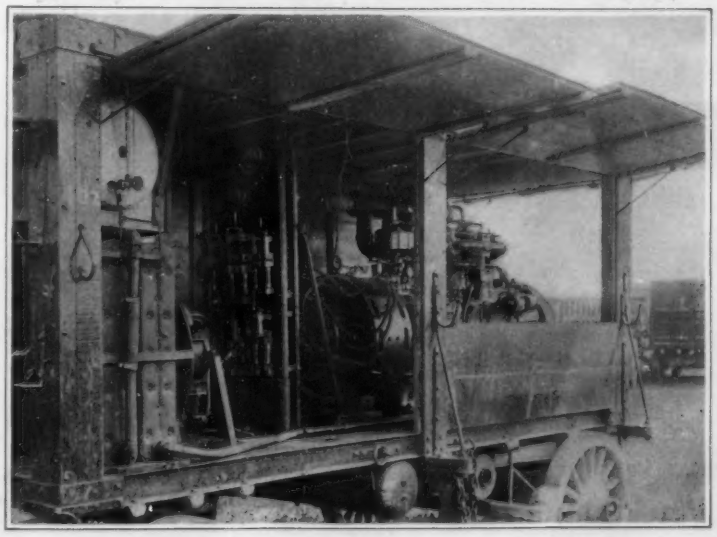


Photo, by Mr. Nathaniel Dewell, courtesy of Pan American Union.

The Chagres in mad flight over the Gatun spillway.



Machine that builds fifty square feet of road per minute.



Gasoline-electric plant for lighting a circus.

Poison Bottle Alarm

WE can give no estimate of the number of lives that have been lost or endangered by the careless one who picks up a bottle from his medicine chest in the dark. But this thing is being constantly done, and measures should be taken to prevent it. Recently the matter has been given prominence in the daily papers, owing to the death from this cause of several persons of prominence. It has been suggested that poisonous tablets be given a peculiar shape, different from ordinary tablets. Another suggestion is that the bottle be provided with a stopper from which a number of needle points project so that the stopper can not be removed in the dark without pricking the fingers. Still another suggestion (which is illustrated herewith) is to provide the bottle with bells that will sound a warning when it is picked up. If some or all of these methods were adopted, no doubt they would prevent many deaths and much suffering.

Agricultural Progress in Canada

THE Canadian government has appropriated a sum of $10,000,000 to cover a period of 10 years beginning with March 31st, 1913, for instruction and research in agriculture. Part of this will be applied to furthering the work of the Federal Department of Agriculture by assisting and developing the live-stock, dairying, fruit-growing and other industries along lines of investigation, improvements in transportation, etc.; while agricultural education of all grades will be materially enlarged. The agricultural colleges are to be improved, elementary schools and short courses in agriculture, horticulture and dairying are to be established, and agricultural teaching is to be introduced into the public schools. The sum of $20,000 a year is allotted to veterinary colleges.

Modern Circus Lighting

GASOLINE torchlights for the circus have gone. To-day we have in their place in the modern circus portable electric lighting plant. The season just closed saw two of the largest circuses equipped with the up-to-date lighting systems.

The accompanying photograph shows one of the unit outfits of the 25-kilowatt portable gasoline-electric plants that have been manufactured by a well known company of electrical engineers especially for these circuses. The sets are made in units and a complete outfit consists of three trucks—two trucks carrying each a duplicate system, while the third truck is the supply wagon and has mounted upon its roof a powerful searchlight. This searchlight is used especially for the aid of workmen employed in tearing down tents, etc., preparatory to loading the circus. There are also in the plant two 25-ampere spotlights used upon the stage.

The outfits are mounted on one of the ordinary circus trucks whose ends and sides are removable. Each plant consists of a compound wound, direct current generator, built integral with the frame and direct connected to the shaft of a four-cylinder, vertical gasoline engine. The set is installed on the rear of the wagon with the flywheel at the outer end. At the front of the truck is installed the cooling system for the engine. This is a pressed steel radiator cooled by motor-driven fans.

A 65-gallon cylindrically shaped water tank is mounted over the radiator. Underneath the truck in the center is swung the gasoline tank and engine muffler.

All tents are equipped with protected wiring which can very readily be either taken down or installed for use when necessary.

Inventions New and Interesting

Simple Patent Law: Patent Office News; Notes on Trademarks

Recent Improvements in Conveying Devices

THE importance of the problem of transportation is self-evident. That the remarkable development of the past hundred years would never have been possible had not the railway and the steamship been invented is a platitude.

From the standpoint of economy, money and energy expended in transportation are a dead loss. In theory merely transporting a thing does not change it. It follows that any step which lessens the cost of transportation, any advance in the art, is a clear gain.

The novel steps in the solution of the problem of transportation, as in the solution of all other industrial problems, usually become a matter of record by being patented. It is the purpose of this article to call attention briefly to some of the apparently more important inventions which have been patented during the past year in that branch of the art of transportation commonly known as "conveying devices" or "conveyers."

Conveying devices, as distinguished from cranes, elevators, hoisting machinery, railway systems and the like, are chiefly of five types; namely, endless carriers, reciprocating or step-by-step conveyers, screw or spiral conveyers, fluid pressure devices, and chutes, spouts or rollerways down which material is impelled by the influence of gravity.

Ordinarily conveyers move material comparatively short distances, seldom more than a few hundred feet. They are often found in relation to some machine or structure, in which case they may become highly specialized in form yet retain and exercise but the one function—the moving of material—as in pneumatic stokers and furnace-charging devices.

Endless Carriers.

Endless carriers are for the most part wheels, the axes of which may be either horizontal, vertical or inclined, and belts. The term "belts" is here used in a broad sense, and includes endless chains of buckets and endless carrying cables, as well as the ordinary flat belt.

The flat belt has many desirable features. It is simple, strong and has great carrying capacity. The last may be increased by the use of a series of troughing rollers that tilt the edges of the belt up, thus making its cross-section trough-shaped.

A patent (No. 1,021,846) on an improved form of troughing roller was granted to Mr. R. T. Pearce of Montclair, N. J., April 2nd, 1912. To the roller-shaft are keyed the usual central pulleys (Fig. 1). This shaft is supported by and turns in two end pulleys of bell-shape, that are mounted in fixed journal boxes. As the belt passes over the set of pulleys the central pulleys turn at a rate corresponding to the speed of the belt. The bell pulleys, being of larger diameter than the central pulleys, turn in the journal boxes at a lower speed. The central pulley shaft turns in the bell pulleys at a speed equal to the difference in the angular speeds of the belt and central pulleys. The advantages claimed for this arrangement are that it is simple, and that the friction between the belt and the pulleys and between the pulleys and the journal boxes is reduced to a minimum.

In case the flat belt is to be used on inclines some means must be employed to prevent the material, especially if it be of a granular nature, from sliding or rolling back down the belt and accumulating at the bottom. Slats, hooks, buttons and the like have been used.

Mr. E. C. L. Van Wert of Valhalla, N. Y., has obtained a patent—No. 999,419, August 1st, 1911—on a device for this purpose, consisting of a set of three plates that when attached to the belt forms a combined belt and bucket conveyer. The larger of the plates, as indicated by Fig. 2, is riveted crosswise of the belt at its center. Flanking the large plate at each side is a smaller plate similarly secured to the belt. The tops of the small plates are connected to each other by a tension spring that causes the edges of the belt to tilt up or "trough." Thus this construction, besides preventing material from sliding down the belt, also dispenses with the troughing rollers commonly used.

In the past few years there has been considerable demand for a satisfactory device for elevating ashes and other refuse from the basement of city buildings to the sidewalk. Such a device should, of course, be simple. It should be collapsible in order that it may be stored underneath the sidewalk. It should be easily fed, of large capacity, so that it may interfere with sidewalk traffic as little as possible, and should deliver material directly to a wagon or other vehicle standing at the curb. Reciprocating elevators, blocks and tackles, swinging cranes, and, in a few instances, endless carriers have been used for this purpose. In a patent No. 1,025,168, issued May 7th, 1912, to August Sundh of Yonkers, N. Y., there is described a novel device of the last class.

In this device, as shown in Fig. 3, a counterbalanced frame normally beneath the sidewalk carries a sidewalk cover and also supports a swinging frame. Passing over a pair of sprocket wheels at the head of this swinging frame and around a pair of driven sprocket wheels located in a pit in the basement floor is an endless chain of buckets. In use a wagon is backed up to the curb, the counterbalanced frame is raised, the bucket-carrying frame swung out, and an electric motor by which the lower sprocket wheels are driven is thrown into operation. Material shoveled into the pit is delivered to the wagon without further handling.

The endless conveyer finds considerable use in connection with drying chambers. A form now being widely adopted by laundries is an endless member, usually a sprocket chain, that passes around sprocket wheels or pulleys whose axes are arranged vertically. Hangers, constituting means for attaching garments to the chain, are secured along it at intervals.

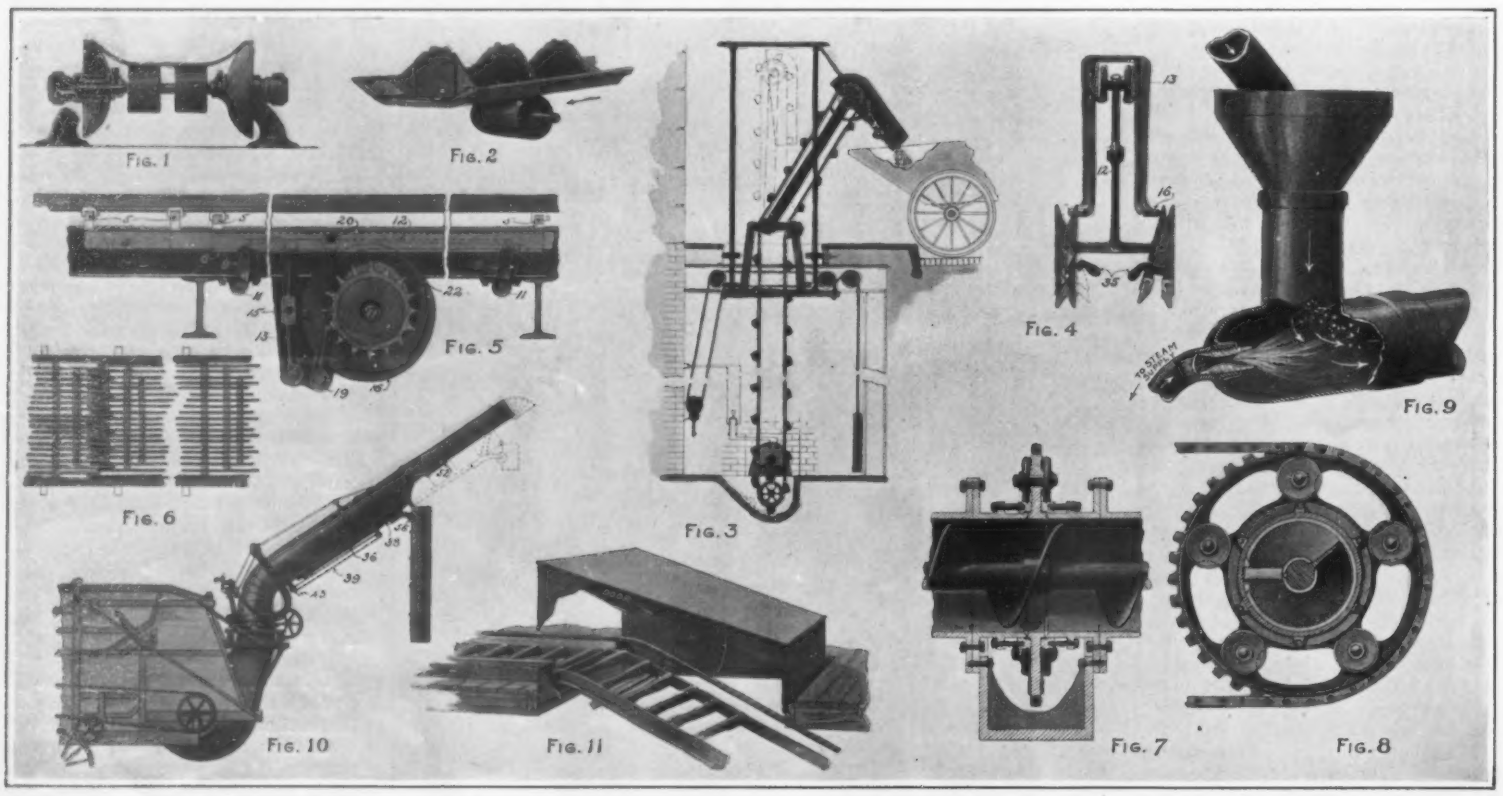
Patent No. 1,025,853, was issued to William Bartholomew of Chicago, Ill., May 7th, 1912, for a novel and at the same time simple hanger. In Fig. 4 the chain 12, supported by carriages 13 that travel on overhead tracks, is shown provided with two oppositely arranged hangers. The hanger consists essentially of two jaws, one fixed and the other pivoted thereto, that are normally held closed by a spring. A dog pivoted to the fixed jaw is arranged to drop in and engage behind the edge of a slot in the pivoted jaw to hold it open when desired. The dog is extended at 35 to form a handle. At the point where the garment is to be discharged an inclined face 16 is arranged in the path of the upper end of the pivoted jaw.

The operation is as follows: The attendant inserts the garment between the jaws, then grasps the handle and lifts the dog. As soon as the dog clears the edge of the slot the spring causes the jaw to close upon the garment. The hanger then passes through the drying chamber. As it emerges from the chamber the upper end of the pivoted jaw comes in contact with the inclined face, which forces the jaw open and allows the garment to drop. At the same time the dog falls behind the lower part of the pivoted jaw, thus automatically holding it in position to receive another garment.

Reciprocating Conveyers.

Reciprocating conveyers, by which are meant those devices that impart a step-by-step movement to the load, are chiefly of two kinds, the reciprocating trough and what may be termed the reciprocating bar. The first type, as the name suggests, consists of a reciprocating trough-shaped frame in which the material rests throughout the whole conveying operation. The speed of the forward stroke is usually greater than that of

(Concluded on page 402.)



Recent advance in the art of improving conveying devices that lessen the cost of transportation.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

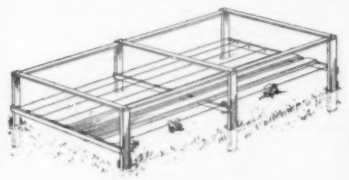
SKIRT MARKER.—EMILY A. HAVENS, 41 Court St., White Plains, N. Y. Among the objects of the invention is to simplify and improve skirt marker devices whereby the device may be accurately adjusted according to the length of the skirt desired, and when so adjusted will remain in a fixed position until the operation is completed. It may be folded into a small compass when not in use and may be conveniently carried or packed away.

Electrical Devices.

TROLLEY.—S. G. VALLES, Cabzadodel Cerro 853, Habana, Cuba. This invention relates more particularly to a trolley having loosely mounted brushes. The object is to provide an inexpensive, simple and reliable trolley in which the working parts can be quickly interchanged without the displacement of the trolley.

Of Interest to Farmers.

PLANT PROTECTOR.—E. R. DRAKE, DeLand, Fla. This invention is an improvement upon the one for which Mr. Drake received Letters Patent No. 932,972 particularly adapted for use in the cultivation of plants, peppers, tomatoes, eggplants, and other vegetables. The engraving shows a perspective view of a skeleton frame which is rectangular and oblong. The object of using the two boards at the bottom which are on the south side of the frame is to blend the rays of the sun from the time the plants are set out, so as to prevent the rays striking the plants with full force; and the object of the wires is to hold the plants or vines and keep them off the ground. The top of the frame may serve for supporting burlap or other coarse fabric or planks for protecting the plants.

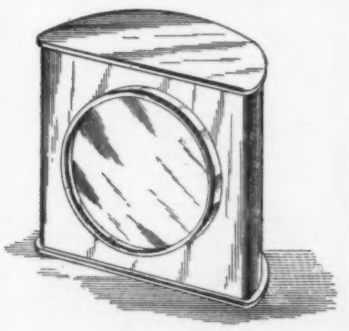


PLANT PROTECTOR.

PLOW.—G. I. DE FORCE, care of L. E. Stancliff, 26th St. and Brown Ave., Erie, Pa. This device absolutely overcomes side draft in sulky or riding plows and is capable of attachment to any kind of wheel supported plow. It may be attached without change in the plow, and is capable of adjustment in accordance with the character of the soil, and does not increase the draft, but on the contrary, lessens it, and will assist in pulverizing the soil without interfering with the turning of the furrow slice.

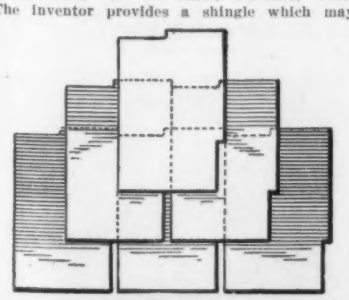
Of General Interest.

VANITY BOX.—L. MORSE, care of Rite Specialty Co., 35 W. 36th St., New York, N. Y. This invention provides a box of novel and attractive form and construction having special adaptation for being carried in a hand bag or the like or for use upon a dresser. It provides a holder or receptacle for a powder puff whereby the same is carried and kept in a proper form for use.



TOILET VANITY BOX.

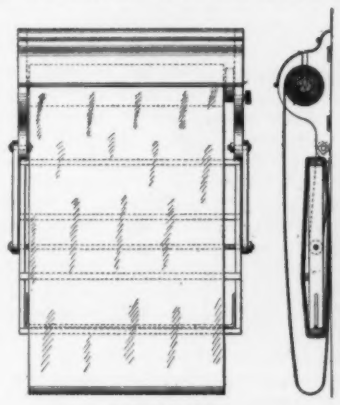
SHINGLE.—W. S. ORTH, Dunkirk, Ohio. The inventor provides a shingle which may be fashioned from any suitable composition or material adapted for the purpose which can be used for roofing, siding, decorating and other purposes by means of which a water and weatherproof cover can be applied to roofs or walls, which is so constructed that the shingles can be accurately spaced and located when being applied, by means of which the use of striking lines or straight edges is obviated as the shingle constitutes a gage in itself, and which minimizes time and labor in applying the shingles.



SHINGLE.

Household Utilities.

TOWEL HOLDER.—E. A. HOOD, care of Horner, Martens & Goldsmith, Pierre, S. D. The invention provides a holder having a roller on which the towel is normally rolled, and a flat reel pivoted to pivoted arms to which an end of the towel is secured, and on which the soiled portion of the towel may be wound so that the reel carrying the soiled portion of the towel may be disposed in a vertical position against the wall out of the way, and supported by the arms.



TOWEL HOLDER.

CURTAIN ROD SUPPORT.—J. KRODER, 107 E. 17th St., Manhattan, N. Y., N. Y. The purpose in this case is to provide a support or bracket, arranged to permit the manufacturer to conveniently assemble the parts and to allow the user to readily place a curtain rod in position on the support or to remove it therefrom whenever desired to place a curtain on the rod or to remove it therefrom.

Machines and Mechanical Devices.

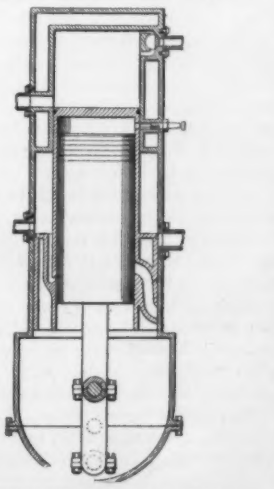
WIRE CLOTH OR SCREEN MACHINE.—O. W. CHILDS, Nash, Okla. The invention provides a device for holding a number of rolls of wire cloth of different size, each in a position easily accessible for inspection and sale, and wherein means is provided for registering the amount of cloth remaining after each sale, and wherein an indication of the said amount and quality is always visible.

ARTIFICIAL LIMB.—J. B. STAGE, Wabeno, Wis. The object here is to provide a structure in which the various parts are so articulated as to move in a similar manner to the natural limbs. Another object is to provide an artificial leg with an articulated foot, and means co-acting therewith for causing the foot to move pivotally as the leg is swung so as to produce substantially the same effect as a natural leg.

MACHINE FOR CLEANING SEPARATOR DISKS.—J. HANSEN, Rendebanen 1, Kolding, Ribe, Denmark. Cleaning the skimming disks of the bowl-inset in centrifugal cream separators is a very troublesome process, since the dirt in the milk is deposited on the disks in hard cakes, or crusts, which can be removed only by means of strong and long-continued brushing after previous soaking in diluted sodalye. This machine in a few minutes can clean a large number of skimming disks.

Prime Movers and Their Accessories.

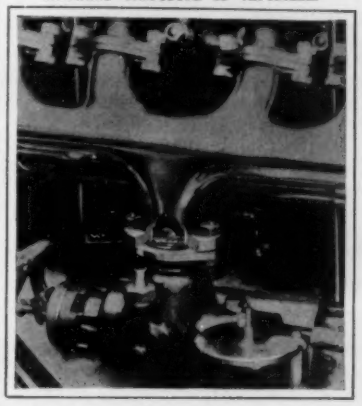
INTERNAL COMBUSTION ENGINE.—E. G. BOGUSCH, care of W. D. Slator, care of the Llano National Bank, Llano, Tex. The invention is an improvement in that class of explosive engines in which two hollow pistons are employed, one working slidably within the other, and both connected with a triple crank shaft in such manner that they reciprocate simultaneously in opposite directions. An advantage lies in a portion of the apparatus serving as an aid in the scavenging of the explosive chamber and practically as an air pump for special uses. The engraving illustrates vertical section of the entire engine, showing the pistons in the position they occupy when the explosive mixture is ignited by a spark plug.



INTERNAL COMBUSTION ENGINE.

VAPORIZER FOR GASOLINE ENGINES.—J. VON WALDY, M.E., 125 E. 23rd St., New York, N. Y. The vaporizer is made in a double dome shape of wire gauze. In the center between the two layers of wire gauze is located the vaporizer made of a special absorbent material that simultaneously vaporizes the gas mixture to a vapor. The result is, any raw gasoline is prevented from getting into the cylinders and cutting the oil, causing the motor to run with less friction, increasing the compression and producing more power, at the same time preventing the carbonizing of the cylinders. The device effectually prevents any flame from shooting through and igniting any gasoline near the carbureter due to back firing. Tests have shown a saving of 25 per cent to 50 per cent of gasoline. To the automobile and truck owner this safety device and economizer should prove of value.

SHOWING STRUCTURE OF VAPORIZER.

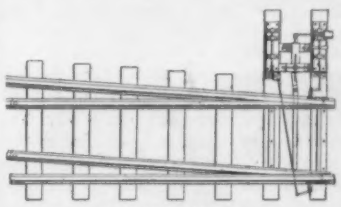


THE VAPORIZER AS ATTACHED BETWEEN THE MOTOR AND CARBURETER.

VAPORIZER FOR GASOLINE ENGINE.

Railways and Their Accessories.

RAILWAY SWITCH.—C. A. TURNER and A. B. EDWARDS, P. O. Box 355, Hamlet, N. C. An object in this improvement is to provide means for positively locking the switch tongues, so as to prevent accidents due to the movement of the tongues away from the rails. A further object is to provide means connected with an ordinary switch stand for operating the tongue-locking mechanism. No more effort is required to operate this switch and the switch locking mechanism than in the ordinary switch. The illustration shows a plan view of the device.



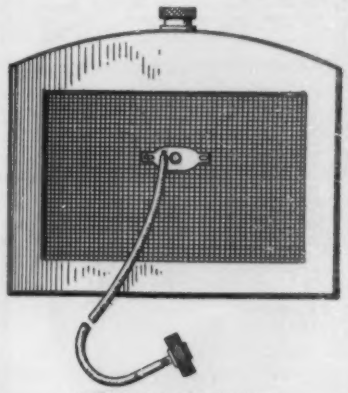
RAILWAY SWITCH.

Pertaining to Recreation.

GAME APPARATUS.—E. KRANCHER, 416 62nd St., Brooklyn, N. Y., N. Y. The invention relates particularly to apparatus for mechanically playing football by means of a number of figures representing a team of players lined up in proper order and arranged upon a board; and the apparatus comprises a ball and means for causing a figure of another player to be spring-actuated to kick the ball across the board and through the team of players.

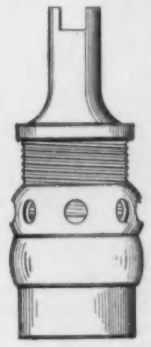
Pertaining to Vehicles.

AUTOMOBILE ATTACHMENT.—J. W. GOLDEN, Sweetbriar, N. D. This invention relates particularly to an apparatus whereby to facilitate the cleaning and polishing of the brass parts of an automobile, the object being to provide a flexible power transmitting member having means at one end whereby it may be attached to a selected one of the engine rotated shafts and having at its opposite end a rotary brush which may be either abrasive or polishing.



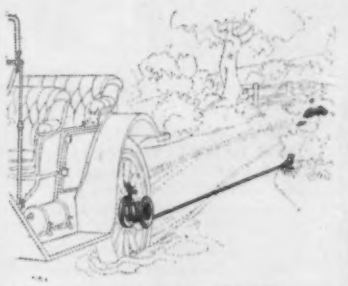
AUTOMOBILE ATTACHMENT.

TIRE DEFLATING CAP.—JACOB H. HARD, Allen, Neb. The object here is the provision of two caps, one of which is provided with an internally threaded end of the same diameter as the cap, and the other cap is externally threaded for engaging either the ring or the cap, and both caps are provided with pins extending centrally from the inclosed end of the caps, and the pin of the inner cap is provided with a transverse notch.



TIRE DEFLATING CAP.

ATTACHMENT FOR AUTOMOBILES.—T. C. BEAN, Glen Ullin, N. D. This invention has reference more particularly to a device which comprises a drum, and means for attaching the same to one end of the driving wheels of the vehicle, the attaching means serving to hold the drum against displacement by the turning movement in either direction, but permitting the removal of the drum by a movement in the direction of the axis of the drum.



ATTACHMENT FOR AUTOMOBILE.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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LaPorte Indiana

The Continuous Rail in the United States

(Concluded from page 397.)

overlapping joints, this holds the rail ends in perfectly rigid alignment, and maintains them against both vertical and transverse stresses, but is sufficiently flexible and at the same time has a spring grip contact of such strength as to withstand the vibration and jarring set up by heavy traffic, and so effectually prevents the joint becoming slack or working loose. It automatically adjusts itself to the rails and is more quickly assembled than the ordinary fish-plate.

Section of continuous rail, showing base rail and crimped-on head.

The construction of the track is carried out in exactly the same manner as when using ordinary rails, except that the jointing ends of the rails engage one over the other for a length of four inches.

Renewals of the continuous rail can be carried out with less interruption to traffic than on the ordinary system, as the overlapping joints will carry the trains before the rails have been fished together, and while they are being fished.

Recent Improvements in Conveying Devices

(Concluded from page 400.)

the return stroke. The material is thus caused to travel in a succession of forward and backward steps in each of which the forward step is the greater. In the second type the load is moved forward by a bar or similar element upon which it may rest or beneath which it may lie. The feature that distinguishes this type from others, however, is that the load is supported, during the return stroke, by some element other than the bar which has moved it forward. Thus, there is applied to the load only a succession of forward impulses.

The supporting element may be another bar or series of bars, counterparts of those that have given the first forward movement. Each bar may consist of a series of parallel bars, in which case those of one set are arranged alternately or in interfingered relation with those of the other. Heretofore not more than two sets of bars have been used in a single conveyer-unit.

Pierre Lorillard of Tuxedo Park, N. Y., obtained a patent on August 15th, 1911, No. 1,000,828, on a similar form of conveyer in which three sets of bars are employed. As shown in Figs. 5 and 6 every third bar is a part of the same set. The mechanism by which the bars are moved is shown in Fig. 5. The bars of each set are connected by crossbeams 5 that are mounted on sills 6. Each sill is supported on rollers carried by two similar rock arms 9 pivoted to rigid supports at 11. The tops of the rock arms are connected by a link 12. This link is pivotally connected to an arm 13 that is mounted to swing on the rod. Near the middle of arm 13 is a roller 15 that bears on the outer face of a cam 16 secured to power-shaft 17. Arm 18, mounted to swing on rod 19, is connected to sill 6 by a pin-and-slot 20. A roller 21, near the middle of the arm, travels in cam slot 22 cut into the face of the cam 16. Each set of bars is operated by a similar mechanism, the three mechanisms being arranged, however, 120 degrees apart.

The operation is as follows: The rotation of the cam causes arm 13 to swing which throws the rock arms to a position nearly vertical, thus elevating the bars of the set and lifting the load. At the same time roller 21 swings arm 18, causing the set of bars to move longitudinally with the load. At the end of the stroke the bars sink and deliver the load to the rising bars of another set. The first named set then returns to its initial position.

In installations comprising only two sets of bars the load receives somewhat jerky motion that is said to be largely overcome by the present device. It is also said that less power is required than was necessary with the older forms.

Screw Conveyers.

The screw conveyer is particularly well adapted to handle granular material. Its most desirable features are its simplicity, there being few parts, all of which may be protected, to a considerable degree, from wear, and its compact form.

Screw conveyers are of two types, one consisting essentially of a screw or helix mounted upon a shaft that is rotatable in a fixed casing, and the other, a rotary casing to which the blade of a helix or screw is internally attached.

The first type is the one usually employed. In it the screw has been driven heretofore by means of power applied at the end of the shaft. In installations of considerable length difficulty has been experienced because of the twisting of the shaft. The metal in the screw being farther removed from the axis of the shaft than the metal of the shaft itself, has more effectively resisted the tendency to twist. As a result internal stresses that in some cases have caused the blade to separate from the shaft have been set up.

By means of the device patented by Mr. W. D. Mount of Saltville, Va., on July 16th, 1912—No. 1,032,850—it is designed to overcome this difficulty by driving the conveyer from a plurality of points along its length. As indicated by Figs. 7 and 8 this device consists primarily of a hollow sprocket wheel that is fitted between the ends of adjacent sections of the conveyer casing. In order to prevent spilling of material, spring-held bearing rings are arranged to fit snugly against the opposite faces of the sprocket wheel. Pairs of rollers, mounted on the sprocket wheel, that travel on the outer surfaces of the bearing rings serve to center it in respect to the conveyer shaft. To the conveyer shaft is secured a radial arm that engages with and receives motion from a pair of lugs in the bore of the sprocket wheel. Power applied to the teeth of the sprocket wheel acting through the lugs and arm rotates the conveyer shaft. There is no interference with the flow of material in the casing.

Fluid Pressure Conveyers.

Fluid pressure conveyers are of two types: In one, fluid under pressure higher than that of the atmosphere is introduced behind the material; in the other the material is drawn forward by suction. Both types are used to a large extent in handling substances of granular or fibrous nature, particularly ashes, sawdust, cotton, grain and the like.

In patent No. 1,020,962, March 26th, 1912, granted to Cornelius Cable of Elkhart, Ind., there is described a conveyer of the type first referred to above. The novelty is said to reside in a special form of nozzle through which the conveying fluid, in this case steam, is admitted to the conveyer pipe. As shown in Fig. 9, the nozzle is provided with flaring ends. The end opening into the conveyer pipe has a smooth bore; the other is rifled or grooved internally. Upon steam being admitted the material is given a whirling motion that tends to prevent it from adhering to the conveyer tube.

Within the past few years fluid pressure conveyers, known as "pneumatic stackers," have largely displaced other forms used in carrying straw from a threshing machine to a barn or stack. The pneumatic stacker consists of a fan and its casing, a conveyer tube, and a hood or distributor that is attached to the upper end of the tube. Since it is desirable to discharge the straw at various distances from the machine the tube has heretofore been made telescopic.

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Inquiry No. 9343. Wanted the name and address of manufacturers of machines for grinding the peel of oranges and grapefruit.

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This cabinet contained a very large quantity of our most valuable current records and was sitting in our office on the second floor. The fire burned the floor out from underneath it and let it fall into the hottest part of the building which was destroyed. The fact that we have given you an order for another cabinet of the 1913 Model is sufficient evidence that we believe the safe cabinet is all you claim for it.

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A decidedly novel form of stacker tube is that patented by Mr. F. L. Sattley of Indianapolis, Ind., No. 997,936, July 11th, 1911. It comprises a non-telescopic tube-section having the lower half of its upper end cut away as shown in Fig. 10. To the upper edge of the lower half of the tube-section is hinged a filler that consists of a number of hingedly-connected semi-cylindrical sections. A guideway 36 is secured to the lower side of the tube. A bar 38 carrying rollers 56 and hood or deflector 52 may be moved in and out along this guide, by means of an endless cable 39 and crank 43. The hood fits closely to and slides along the inner surface of the upper end of the tube. It is probable that the tube is more rigid than those formerly used since it may be made in a single piece.

Operation: Assuming the filler to be in the position shown in fat lines, material passing up the tube strikes the hood and is deflected downward. In case it is desired to discharge the straw farther out, the crank is turned, thus projecting the bar and causing the rollers to bear against the uppermost of the filler-sections which is thereby swung up against the tube. In this manner the cut-away portion of the tube can be filled step-by-step while maintaining a constant relation between the deflector and the end of the filler.

Gravity Conveyers—Accessories.

It is often necessary to install conveyers so as to carry material from room to room or from story to story. The passageways through walls or ceilings obviously become excellent avenues for the spreading of fire. Although building regulations in many cities require that provision be made for confining the fire to a single room, very few devices for this purpose have been patented.

Patent No. 1,022,525, issued April 9th, 1912, to B. H. Alvey and M. U. Bernheim of Louisville, Ky., covers a fire-hood designed for co-operation with a rollerway. As shown in Fig. 11 it consists of a metal frame, open at one end, that covers the opening in the floor. The opening in the frame may be closed by a door that swings on a horizontal pivot arranged across the upper edge of the opening. The door may normally hang in a vertical plane or may be secured to the roof of the hood by a fusible link. When closed it abuts against a filler that extends from the floor to the upper edge of the rollerway.

The operation of the door is obvious. In case the fusible link is not used, packages coming down the rollerway strike the door, swing it up and pass on, after which it immediately swings shut. When the link is employed the door closes only when the temperature in the hood equals or exceeds the fusing point of the link.

Losses in the Ohio Valley Flood

THE United States Geological Survey has just issued Water Supply Paper 334, dealing with the Ohio Valley flood of March-April, 1913. In view of the widely divergent estimates of losses that were current at the time of the flood, and the fact that these losses were undoubtedly greater than in any previous visitation of the kind in the same region, much interest attaches to the figures on this subject collected by the Survey by means of circular letters sent to the officials of two hundred and six cities and towns in the flooded district. The losses reported by the towns in question, added to the losses reported by railways and traction lines, total $180,873,097. These figures represent actual damage, and do not include indirect, or "economic," damages. Moreover, they apparently take no account of losses sustained by the rural community, outside of town limits. Certainly $200,000,000 is a very conservative estimate of the total actual and immediate losses. Considering that this loss was due to a single flood, in a region in some part of which floods occur from once to five times each year, one gathers an idea of the immense sum of money that the nation is justified in spending on preventive measures. From the same sources of information the Survey learns that 415 lives were lost in the flood.

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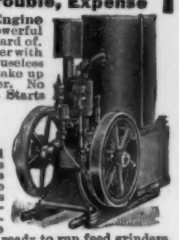

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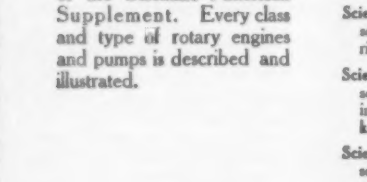

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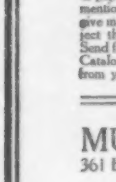

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Notes and Queries.

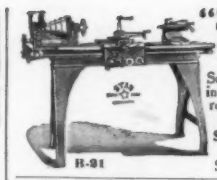
Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12864) G. L. asks: As a reader of your invaluable paper could you kindly inform me what is the relative length of the two branches in the telescoping tube apparatus used for demonstrating a peculiar aspect in the propagation of sound, in the case when sound emitted by a body is silenced by neutralizing itself? A. The question which you ask has reference to the interference of two systems of sound waves. The two paths for the waves must differ in length by a half of a wave length for the first interference. If the sound wave is 2 feet long, the half wave length is 1 foot. Now if one side of the telescoping tube is 3 feet long, the other side will be 2 feet long. Whatever the length of the longer path for the sound the shorter path will be one half of a wave length less. This subject is fully discussed in Poynting and Thompson's "Sound," which we send for $2.75. Illustrations are given of the apparatus, and the whole subject is made perfectly plain and clear, both for the first and the higher interferences.

(12865) T. C. M. asks: Will you inform me if there is any foundation for the belief that is prevalent that an electric fan in a room will lower the temperature? In other words, if an electric fan is placed in a closed room in hot weather and allowed to run for some time, will the temperature of the air in the room be reduced? Will a thermometer in a closed room read lower when the current of air from a fan blows directly on it than when the fan is turned off? A. An electric fan does not directly tend to lower the temperature of the air in a room in which it is running. On the contrary, the mechanical blows which it gives to the air tend to raise its temperature, according to the mechanical equivalent of heat. A thermometer placed in front of the fan with its bulb dry will not read lower by reason of the motion of the air across it, but a thermometer with a wet piece of linen or other thin cloth upon its bulb will read lower in the current of air from the fan. This experiment explains the cooling action of an electric or any other fan. The air which is blown across the skin of a person takes up water vapor if it is not already saturated with water vapor, that is, the air evaporates the perspiration. Evaporation is always accomplished by heat. The heat necessary to evaporate the perspiration is largely taken from the body of the person, and therefore the person is cooled by the current of air from the fan. The air is not cooled by this action. That it feels cooler does not prove that it is cooler. A person may shiver and take cold in a current of dry air where the thermometer shows above 100 degrees. Feeling and fact regarding the temperature of air in a room are often quite at variance with each other.

(12866) F. H. asks: 1. Is there any way by which I can erase a two months old scar on my forehead, and if so what is it? A. The question of the disposal of a scar on your skin would better be referred to your physician. We do not answer surgical or medical queries. 2. What are the atomic weights and symbols of the following elements: Coronium, etherion, metargon and polonium? Are these elements? A. The substance coronium has not, so far as we have noted, been found on the earth. At least the supposed isolation of it is now considered to have been a mistake. It is found in the solar corona, and gives the spectrum line 5303. Etherion was announced by Dr. C. F. Brush in 1898 as found by him in an exhausted glass bulb. Prof. William Crookes has shown that it was probably the rarefied vapor of water. Metargon has been shown to be carbon monoxid in the air. Polonium is the same as the radio-active bismuth of Geisel, and has been shown by Rutherford to be a disintegration product of radium and also of uranium. From this it is evident that symbols and atomic weights cannot be given for any of them. None of them has been admitted to the list of elements. 3. How many elements are there now? A. The 1913 list of elements contains 80 names. 4. Which is the heavier—gold or platinum? I find in the *Journal* of the American Chemical Society, vol. xxvii, No. 1, the atomic weight of gold given as 197.20, while that of platinum is 194.80, making gold the heavier. Can this be a misprint? A. The density or specific gravity of gold is 19.26 to 19.34; that of platinum is 21.20 to 21.70. The numbers which you give are the atomic weights as compared with hydrogen as unity, and do not express density. 5. What is the address of the radio inspector of the second district? A. The addresses of the radio inspectors can be obtained from the Department at Washington, D. C. We regret that we have not the list at hand to give you that of the second district.

(12867) D. M. asks: I read a few weeks ago that the Northern Lights were no doubt caused by an illumination in very rarefied air due to electrons coming from the sun. Now, knowing that your staff is a great authority on such subjects, I would appreciate it greatly if you could explain as briefly as possible just what electrons are. A. An electron is a very minute particle of a gas charged with negative electricity. Some think it is negative electricity itself.



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